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THE NATIONAL PHYSICS AND CHEMISTRY EXAMS AND THE LEARNING OF SCIENCES

(OS EXAMES NACIONAIS DE FÍSICA E QUÍMICA E A APRENDIZAGEM NAS CIÊNCIAS)

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To my parents, Emília and Rui, and to all my family.

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Abstract

This work has as its starting point the acknowledgement of significant fluctuations in the degree of difficulty of the Physics-Chemistry national exams. The study of these fluctuations from 1949 to 2005 aims to understand to what extent the differences, which occurred in the content, the structure of the exams, and the adopted standards, are reflected on the degree of difficulty they present. It reports and provides comparative standard-setting results of Portuguese exams of Physics and Chemistry for the nine and the last years of secondary schooling through the use of different item-grouping approaches. Three standard setting methods, Contrasting Groups, Beuk and Extended Angoff, were applied in order to study the differences in item, panellist and item difficulty in final performance.

Initially, my goal in this work was to investigate the existence of possible differences in exam results in a logical and holistic manner, as to promote improvements in the teaching and learning process. I found, however, that it was very difficult to establish a single difficulty variation pattern due to the heterogeneity of the results. Even though the cognitive analysis allowed for the creation of a group of items, the evolution in the exams analysed, in a 50 year period, reflects the changes in the educational policies and allow for other considerations to be pondered based on different political, social and economic contexts.

Key-words: Evaluation Models; Measurement Techniques; Test Building; Data Analysis; Educational and Evaluation Standards

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Abbreviations

AERA	American Educational Research Association
AHME	Historical Archive of the Ministry of Education
APA	American Psychological Association
BEMA	Brief Electricity and Magnetism Assessment
BESEL	Library of the Lisbon School of Education
BFCT-UNL	Library of the College of Sciences and Technology of the New University of Lisbon
BFC-UL	Library of the College of Sciences - University of Lisbon
BN	Portuguese National Library
B-on	Online Library of Knowledge
CR items	Constructed-response items
CR-INE	Resource Centre of the Institute of Educational Innovation
CSIP	Board of Public Instruction
CSPOPE	Secondary Courses Mainly Aimed at Continuing Studies
CSPOVA	Secondary Courses Mainly Aimed at Working Life
DG	Government Diary
DGEL	Directorate General of High School Education
DGEN	General Directorate of High School Education
DGES	Directorate General of University Education
DGIP	General Directorate of Public Instruction
DL	Decree-Law
DR	Diary of the Republic
EG	Exam Grade
ENES	Secondary School National Statistics

FMS	Mário Soares Foundation
FPCE-UL	College of Psychology and Educational Sciences of the University of Lisbon
GAVE	Office of Educational Assessment
GEPE	Office of Educational Statistics and Planning
IEL	Inspection of High School Teaching
IFG	Internal Final Grade
IMAE	Institute of Audiovisual Media for Teaching
INE	Portuguese National Statistics Institute
IRT	Item Response Theory
JNE	National Examinations Jury
MC	Multiple-choice
MCGM1	Modified Contrasting Groups Method variation 1
MCGM2	Modified Contrasting Groups Method variation 2
ME	Ministry of Education
MEC	Ministry of Education and Culture
MEIC	Ministry of Education and Scientific Research
MEN	National Ministry of Education
NBPTS	National Board of Professional Teaching Standards (USA)
NCME	National Council on Measurement Education (USA)
PIDE	State Defense and International Police, in effect a politicized secret police (Polícia Internacional e de Defesa do Estado)
PR	Passing Rate
RTP	Portuguese public service broadcasting
SAAP	Propaedeutic Year Support Service
SD	Standard Deviation
SGME	General Secretariat of the Ministry of Education
SN	Student's number
SPSS	Statistical Package for the Social Science
TPU	Pre-University Texts
ULHT	Lusophone University of Humanities and Technologies

1 Introduction

> "...to use a magnifying glass to assess an exam is to look at a tree and lose sight of the forest." (Grácio, 1996, p. 134)

There is a growing consensus regarding the need to increase and deepen the debate over the quality and efficiency of the production and distribution of knowledge by the educational system, and the strategic question of its evaluation. Several theories and methods were developed since the 50s[1] allowing the comparison of the evaluation results of the learning of different populations in different times and spaces. Analysing exam organization, its contents and pedagogical objectives, the grading methods, as well as the behaviour of both examiners and examinees when faced with the learning is an important aspect for the debate regarding exams in Portugal and elsewhere.

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[1] Examples of those theories are: Item Response Theory (IRT) (Baker, 2001; DeMars, 2010), Classical Measurement Theory (Lord & Novick, 1968) and the Evaluation Model of the Learning Results (Kolb, 1984), associated with the idea of *accountability*, i.e., that the production and distribution of information regarding the knowledge that students acquire in school are part of the duties of the Government towards the population regarding the quality of the services it provides.

1.1 Motivation

There are presently in our society deep concerns with low school performance. Even though there have been great investments in the educational system, there are still many students that upon failing a national exam leave the system thus contributing to the high percentage of school drop-outs found in Portugal.

This leads to the need to focus on exams as a device to regulate teaching. With this goal, and keeping in mind the central role that grading has taken on the formulation and implementation of curricula and learning, student graduation and certification, the propose of this study is to analyse the evolution of the national exams in Physics and Chemistry as a whole, and the implications they have in the learning process.

The starting point for this investigation is the significant variation in difficulty of the national exams in Physics and Chemistry. This research also adds other reflexions regarding social and political environment as well as the several educational reforms that happened through the years. The analysis of these variations will allow understanding in which way changes in the content and structure of the exams, and in the adopted techniques affect the difficulty they present.

The goal of this thesis is not to defend the pedagogic legitimacy of the Physics and Chemistry exams, considered by some as socially unavoidable (Therer, 1999, p. 2), but to analyse their evolution through the reforms implemented on a limited time horizon. The origin of the time reference for this study is 1948, with the so-called “Pires de Lima reform”, and ends in 2005, with the creation of a unique exam for both subjects of the current curriculum. The reasoning behind choosing this starting point is its “significant evolution in the definition of pedagogical and didactic norms in teaching” (Grácio, 1996, p. 67), which led to the implementation of national exams, replacing the district exams created in local high schools. The exams of the current reform, which first appeared in 2005, were excluded due to the hastened way this reform was implemented, leading to great imbalance amongst students in its first year due to different class loads for the same curriculum.

There are countless debates about exams and their applications, not only in the definition of educational policies in its key points, but also in considering them symbols of peripheral political conflicts regarding race, social class, and gender, which are connected to social and public money distribution criteria.

For that reason, “exams will mainly be whatever we want them to be” (Ferro, 1970, p. 421).

1.2 Exams: a social institution

The analysis of exams as grading tools has raised several questions and fed countless controversies through the years. Nowadays, exams are a “critical” part of the education reform movements and also a way to legitimize educational policies (McDonnell, 2004).

In the 1950s the controversy was centred on the questions asked and their detachment from the curriculum taught, the oral exams (for which appeals were not accepted), and the mistakes found on the tests.

In the 1970s, before the change from a dictatorship to a democracy in 1974, the exams were outdated. The immutability of the contents over decades lead students away from the advancements of science and technology, while new innovative curricula had cropped up, like Project Physics, in USA, or the Nuffield Project, in England (Ogborn, 2002). This period was characterized by the growth of the psychometric movement and the international research for better exam design to measure student’s knowledge and skills at a general level. Due to disgruntling results, there was a second period when exams were criticized (Valadares & Graça, 1998), which led to new approaches reflected on the Reform of Veiga Simão.

The transitional period between 1974 and 1980 is characterized by: (a) political instability, (b) constant changes to the legislation, namely the introduction of the Comprehensive Secondary Education (its implementation was only completed in 1981), and (c) the permanent change of teachers in schools. Still, national exams for access to higher education were accepted, and even the strike movement of February 1975 “had as motive not a refusal of the exams but a refusal of the increase of the exam exemption grade” (Rodrigues, 1978). Another example was the failed one-day strike by the teachers of the Greater Lisbon area, without a single echo of solidarity from the Movimento Associativo Estudantil (Associative Student Movement), even after an unofficial note from the Ministério da Educação e Cultura (MEC) determining that there would not be another opportunity for students besides the second call – even if the first did not happen due to a teacher strike – trying to “awaken” in students the desire to take exams.

The exams of this period were not considered in this study due to several factors. Some of which are:

- It is not possible to accurately know the examinees' grades for the school year of 1973-1974. For instance, the grades at Liceu Camões were altered as many examinees benefited from an administrative grade increase both by the decision of the General Assembly of Teachers of this high school and under memorandum L-T-ES/55/74 of the MEC. After the exams, students were confronted with the structural failure of higher education to absorb all the candidates that wished to attend University (Editores, 1977);

- In the three following school years, the Student Civil Service was created upon completion of high school in response to the thousands of candidates that were waiting for admission to higher education. This year was qualified by several political sectors as a "fraud year" (Brotas, 1977, p. 8) as it did not increase the students' academic knowledge and reflected the "rhythms and contradictions of the democratization process in Portugal" (Oliveira, 2004, p. 5). The occurrence of several strikes did not allow for an unbiased analysis of the exam results. An example of this was the student strike of February 1975, which was fuelled not by a refusal to take exams but a rejection of the increase of the minimal grade for exam exemption. Another strike that had consequences on the 1st call of the exams of 1975 was the teacher strike in the Greater Lisbon area, leading to an informal note from MEC limiting the students who had not taken the exam due to the teachers strike to only go to the 2nd exam call (Rodrigues, 1978). In the two following years the 3rd cycle exams happened at the same time the Comprehensive Education was being introduced, along with the systematic alteration of objectives and curricula. The Student Civil Service survived for two more years and was finally suspended in 17/6/1977, with a law from Parliament. Its suspension happened with the creation of selection and seriation mechanisms for higher education (it now had *numerus clausus* for admission to the majors). A direct consequence of this was the lower number of entering students when compared to the years before the Revolution of April 25, 1974;

- To replace it, the propaedeutic year is created in 1977 surviving until 1980. There were some difficulties with the pedagogic orientation and the timely definition of the curriculum for the different subjects during the first year (Brotas, 1977). It became known as the television year as the classes were being transmitted on television to address the inability of the schools to accept more students. At the end of the school year, the students took two benchmarking tests (there were two sets of tests, each one with three exams designated by the letters A, B, and C), with their results published "about two months after the last exam was taken" (Telmo, 1978, p. 12). To avoid any

> “distortion” in the results the correction of these exams was done by computer, which hinders the analysis of the results. According to one of the Pedagogical Directors of the Propaedeutic Year, Oliveira Marques, “propaedeutic teaching, in the conditions it was offered a year ago, can be considered a hastened act as it lacked the necessary preparation” (Trindade, 1978, p. 10). In the following two years, the wealthiest students obtained the support of private schools while the remaining students only had the possibility of attending some high schools in the district capitals. This situation didn’t offer the examinees an equal opportunity to learn the subject matter tested.

The Educational reorganization was completed in 1981, creating the 12th grade of secondary school. As a consequence of this reorganization, the Ciências Físico-Químicas (Physics and Chemical Sciences) exam is divided into two exams, one of Physics and the other of Chemistry, which replace the 3rd cycle exam in order to end the Secondary School, and survived until 2005. After the implementation and extension phase of the 12th grade to the majority of the secondary schools, there were no “major changes on the grading system which is generally characterized by giving greater emphasis to the classification, selection, and certification procedures, than to the results achieved by the students […]” (Fernandes, 2006, p. 25).

In the 1990s the opinions went from the common sense reaction, based on the progressively lower qualification of students and consequent reduction of the exams’ difficulty defended by Filomena Mónica (1997), to the response of Stöer & Magalhães (1998) based on three aspects – the core of the teaching-learning process is the student, the teaching must be adapted to his characteristics and there has to be an articulation between the school and the modern concept of Educational Community.

The study made by Teodoro et al. (1998) found that the Physics exams in 1996 were clearly more difficult than the exams offered in the four previous decades, going against the opinion of those that insist that “exams were harder in the old days”.

Towards the end of the 1990s a discussion starts regarding a new reform of secondary school in which external evaluations should focus on the competences of reasoning, problem solving and communication (Fernandes, 2008).

It is not the intention of this approach to present a review of the controversial moments of the educational changes through the years, but to show that the Portuguese educational system has higher demands nowadays, both in teaching and curriculum, expecting a higher competence level in abstract thinking along with an increase of curriculum-complementary activities. This complexity (Phelps, 2005) can deteriorate the credibility of the existing tests as indicators of teaching quality as their results usually fall short from the expected. There are many who criticize these tests, but usually that just shows a lack of knowledge of the limitations and benefits of the exams which Popham (2001, p. 26) called “evaluation illiteracy”.

On the other hand, defending the abolition of an external assessment means you will shun an important indicator of teaching-learning as “evaluation is an intrinsic characteristic of knowledge” (Bartolomeis, 1981, p. 40).

It is necessary to keep in mind that there are paradoxes in the debate regarding exams and learning:

I. If the exams are that bad, and if our students do not acquire the required competences, how can we explain our country’s technological development and progress (even if it falls short for the expectations of some)?

II. If the examples (like the Physics and Chemistry exams of the 1990s) and the evidence deny the ever present argument of the lowering difficulty of the exams, how can we explain the scrounging media diatribe presented every year come exam season?

If on the one hand exams are measuring instruments to get information on the students and school performance, on the other hand they are also strategies to reach a wide variety of political goals that affect our educational system. For instance, the curriculum contents subject to school evaluation become critical elements that support politically driven educational interventions.

The points mentioned highlight that the issue surrounding evaluation is “more than a question of pedagogic technique; it is a political problem” (Araújo, 1976, p. 5).

Making exam results public and establishing a school ranking system might work as a coercion factor, so well exploited by the hortatory political theory, “since all policies embody an implicit theory of change” (McDonnell, 2004, p. 25). One can identify two big classes of political instruments: mandates that impose rules and incentives based on financial compensation for achieving certain goals. But the hortatory theory proposes a much subtler and effective instrument that is not based on disapproval or compensation, but on persuasion. Its effectiveness depends on the existence of causal constraints, such as possible penalties. The publication of the statistical results of the exams, for instance, is one of the ways of increasing the effectiveness of this instrument. It is obvious that following the persuasion, mandates and incentives appear for the realization of the educational policies. Still, the line between information (persuasive cries are not enough), and the motivating values and belief in change is very thin (McDonnell, 2004).

To Pellegrino (1999) there were “four major forces that have influenced educational assessment practice from 1957 to the present: Psychometrics, Cognition, Curriculum, and Social-political context of education”. These forces were “related with multiple streams of influence, including social policy and societal goals, theories of the mind, and computational capacities”(1999, p. 7).

One can never say this too often: it is not possible to reflect on the exams by focusing only on the students and on the technical concern of measuring their performance, without also considering the situation in which the learning was done, such as the curriculum, the cultural characteristics of the region, the organization of the School Community, and the part played by the Government.

1.3 Goals and structure of the investigation

The main challenge of this study is, primarily, to analyse the performance of the examinees, by sampling in a set number of schools. The analysis attempts to answer the following questions:

- Are there any differences in the internal and external students’ global performance?
- Are the results of three different standard setting methods similar?
- Are there identical performance behaviours for four selected Physics and Chemistry contents?

These are important questions since every year the difficulty of the national exams is discussed alongside with the expectations towards the learning and the performance of the examinees.

On the other hand, in order to understand to what extent the changes in exam content and structure, and the adopted techniques influence the degree of difficulty, it is necessary to focus our reflexion in the social and political contexts, and on the scope of the several educational reforms that happened throughout the years.

One of the goals of this investigation is the creation of a digital archive containing the Physics and Chemistry national exams, allowing the community to research and analyse them through the Internet.

This investigation is structured as follows. Chapter Two – Exams Legislation is divided in two parts and starts with a summary of the national exams legislation in Portugal from 1836 to 1947 and then presents a typical timeline of the legislation regarding exams in Portugal until 2005, as a way to contextualize their evolution.

Chapter Three – Literature Review aims to review and synthesize current findings as well as theoretical and methodological contributions regarding standard setting methods and evaluate them according to the guiding concept of items. Psychometric theory and cognitive analysis presents the foundation for this analysis.

The sampling, treatment and analysis of the data are set out in Chapter Four – Methodology. The data regarding the exam sheet and results, questionnaires and the cognitive analysis of the items were extracted, compiled and grouped chronologically, according to the educational reforms.

The application of the psychometric tools combined several adaptations keeping in mind the existing statistical data and the format of the items in the exams:

1. in the period between 1950 and 1999,

a) *Beuk Method* (for the years of 1972, 1982, 1983, 1984), as a holistic method;

b) *Contrasting Groups Method*, with a variation based on the average of the grades of the items proposed by Irwin, Bunckendahl, and Poggio (2007).

2. in the period between 2000 and 2005,

a) *Beuk Method* (for 2004 and 2005), as a holistic method;

b) *Extended Angoff Method* (for 2003, 2004 and 2005), with the Angoff True/False variation, suggested by Impara and Plake (1998, p. 69) for multiple choice items, and the extension of the Angoff Method, proposed by Hambleton & Plake (1995, p. 41), for the remaining items;

c) *Contrasting Groups Method*, with the adaptation of the linear regression model proposed by Cizek and Bunch (2007, p. 109);

d) *Content and cognition level of exams items* (for 2003, 2004 and 2005), following previous studies (Ding, 2007; Ding, Chabay, Sherwood, & Beichner, 2006).

This research is focused on the pursuit of reciprocal influences between the theoretical construction and the empirical data, in a constant process of redefinition, re-examination, and confrontation, believing that the research process, being an iterative process, cannot be limited to a set of linear and sequential procedures.

The virtues and potential of this study cannot hide the limitations that a methodological strategy such as this encompasses. Thus we established a triangulation of data, sources, and methods, as a guarantee of its internal soundness. Not only are the investigational techniques explained, as the limitations of the study.

The use of a vast and diverse array of conceptual and methodological instruments, allied to a complex interaction between the problems being investigated, the investigator, and the examinees, creates a privileged way to the understanding and measurement of the problem of grading/evaluation.

On Chapter Five – Results and Discussion, an analysis, on a decade-by-decade basis, of the structure, and content of the exams, and the results of the examinees is presented, as there is a network of endless intersections and inter-relations between them. This seemed to be the best option to present and discuss the results obtained, as the goal is not to simply point out possible differences, but to adequately interpret them so that effective decisions can be made regarding the learning/teaching process. If, on the one hand, a higher level of demand can have negative consequences and lead to a lower morale and to the students' loss of interest on the subject, on the other hand, the performance level of the examinees should reflect and encourage learning activities associated with more complex skills so that the evaluation can model the learning. The exams are analysed as instruments of the educational policies through press articles, with a special focus on the 1950s through the 1970s, with some fleeting incursions to the 1980s through the 2000s.

The final chapter, Chapter Six – Conclusions, provides a synthesis of the major findings and discusses some limitations of the study namely the choice of the psychometric tools and the curriculum contents included on the exams syllabus, analysed cognitively.

With open minds and realizing that there is still a long way to go and that learning is closely connected with evaluation, some guidelines and possible research paths are presented in the end of this study.

A synopsis of the digital exam archive was included as Appendix 1. The digital exam archive can be found online at www.examesfisicaquimica.org. In Appendix 2 you will find the selected Physics and Chemistry multiple-choice exam items from 2003 to 2005 referred in 4.3. The examinees' scores tables to set the performance standards for Contrasting Groups, Beuk and Extended Angoff Methods are in Appendix 3.

The research on exams is due to the general consensus regarding the influence of external exams on teaching-learning, as Orden (1982, p. 7) mentions: "it is a commonly known fact amongst educators that exams (what is demanded of students in exams) define the real objectives of learning and teaching [...]".

Considering assessment as a "function of a future, the one that is prepared, ensured, organized" (Bonboir, 1976, p. 30), this research aims to contribute to that future, without alienating the whole.

2 Exams Legislation

> "The means and ends involved in educational policy and practice are the results of struggles by powerful groups and social movements to make their knowledge legitimate, to defend or increase their patterns of social mobility, and to increase their power in the larger social arena." (Apple, 2000, p. 9)

Educational legislation was one of the starting points for this quest through the history of education. The interpretation of the legislation is based in its context, as this is the only way to understand its consequences in students and schools. This chapter is divided in two parts and starts with a summary of the national exam legislation in Portugal from 1836 to 1947 and then presents a typical timeline of the legislation regarding exams in Portugal until 2005. Laws, decrees, bills of law, decree-laws, notices, and ordinances were all considered in this research, as well as teacher reports, articles written by teachers, and the work of other researchers. All these sources gave insight into, on the one hand, the official vision of education, and on the other hand, the vision of the teachers. In the legislation summary, the choice and interpretation are directed towards the most significant changes in the high school and technical teaching, and appear accompanied by an analysis focused on certain aspects such as: study plan, elaboration and types of exams, and their implementation.

A table with a compilation of the resulting educational system reforms and the curricular reorganizations implemented through legislation during these five decades, where the organization of High School, Basic and Secondary, and the calculation of the weight of the exam grade towards admission in University have to be highlighted, is presented at the end. This table allows a better understanding of the changes that happened in this time frame, particularly the disappearance of the final exams of the 10th and 11th grades in 1983, keeping only the Assessment Exam (Leal, 1991). Still, even though several different formulae were used to calculate the High School/Secondary School final grade, the formula used in 2005 is resembled to the one used in 1947, with the exception of the existence of oral and practical exams. The absence of a direct evaluation of lab practice can be significant due to the experimental character of Physics and Chemistry. One argument for this exception is the standardization of the grading criteria.

The analysis of educational legislation shows the importance of several national and international historical factors for the development of teaching and learning in Portugal.

2.1 Exploratory analysis of the legislation before 1947

Educational legislation was one of the starting points for this journey through the history of education. The interpretation of the legislation is based on its contextualization, as only then can its consequences on students and school in general be fully understood. Educational legislation seeks to promote the progress of society through the debate and introduction of new models and pedagogic experiences.

Laws, decrees, ordinances, rulings, and communications, as well as teacher reports, articles and studies done by other researchers were considered in this research. This abundance of sources allowed for both the official vision of education as well as the teachers' vision. The free online availability of the Portuguese legislation[2], since 1910, was of great help towards its compilation, selection, and digitization. The treatment of other sources, such as the teacher reports collected at Secretaria-Geral do Ministério da Educação (Secretary General of the Ministry of Education), was only possible thanks to their conservation and free access to researchers.

Esteves (1953) did a brief analysis of the legislation starting in 1836 and all the way up to the Pires de Lima Reform. This analysis, presented below, focuses on the following aspects of

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[2] http://www.dre.pt/

some of the reforms: a) study plan; b) exam types; c) test writing; d) jury formation; e) test evaluation.

Decree of 1836 – Did not determine the duration of the high school course or, for each subject, the number of weekly lessons. Teaching was done by field of study distributed into ten subjects awarded to the same number of teachers. In the event that a teacher would have to temporarily miss a class the School Council would nominate an advanced student to replace him, the student would be paid an amount arbitrarily determined by the same Council and paid from the enrolment treasury. On the subject of “Annual Exams” you can find four extremely brief and vague articles.

They simply state that, at the end of the school year, the students would be tested on the subjects they studied; the jury would be formed by the teachers of those subjects and another, and none of them should ask questions about the subjects they taught; the exams were open to the public; and that in the judgment of the tests, through a secret vote, each member of the jury would drop in to the urn the letter A (approved) or the letter R (failed), and that would determine the examinee’s fate.

Decree of 1844 – Suppressed the teaching of Sciences and of French and English, with the rest being distributed by only six subjects. This is the first true reform of our high school teaching but certainly, the selection of students was not the first consideration of the legislator.

Still, for the first time, it is clearly determined that the exams for high school subjects will have both an oral and a written part.

Decree of 1860 – The legislative shoddiness of the two previous reforms regarding exams would be followed by the first serious attempt, with implications in the future, of obtaining the actual performance an exam can give as a way to gauge the knowledge and intellectual capacity of the students.

This decree from the 10th of April of 1860, alongside its regulation, published around three years later, allowed that:

a) French, English, Physics, Chemistry and Natural Sciences, which the previous organization had suppressed, be returned as high school subjects. The course lasted five years and almost all of the subjects were taken for more than one year;

b) The decree established that each subject would have two kinds of exams: monthly and annually. The regulation though replaced the former with three exams (Periodic Exams) to be taken in December, February and May. The scores from these exams would become part of the respective books of terms and each exam would have a grade of good, satisfactory or bad. The annual exams were partial or final depending on if they were referring to the early parts of a subject or the final part. In the first year there were only partial exams whereas in the fifth year, being the final year of the course, there were only final exams;

c) The most interesting innovation of this reform is related to the construction of topics for the annual exams. According to the decree each school should organize, for each subject, a series of at least 50 topics to serve as themes for the oral exams and another identical series for the written exams. After being approved by the respective School Council these topics would be forwarded by the headmasters to the Direcção-Geral de Instrução Pública (DGIP - General Directorate of Public Instruction), who in turn would return them to the school after the Conselho Superior de Instrucão Pública (CSIP - Board of Public Instruction) approved the topics. The regulation though, restricted the creation of these topics exclusively to the teachers of 1st class high schools, which were located in Lisbon, Oporto, Coimbra, Braga and Évora. The headmasters would send their topics for all the subjects to the DGIP (Direcção-Geral de Instrução Pública). After they were approved by the several school councils, the CSIP (Conselho Superior de Instrução Pública) would organize a single series that would serve all the students in all the high-schools in the country's coming exam season. It was the first step towards the single test system currently in place for written tests;

d) The jury at the exams be it periodical, partial or final, was formed by three teachers nominated by the school council. The senior would lead;

e) The exams were taken in shifts with no more than four students at a time. When a group was called in for an exam for a subject, a topic for the oral test would be randomly selected and the exam would start immediately. The duration of each oral exam could not be less than 30 minutes and no longer than 60. As soon as the oral exam was completed the written test would start before the same jury and in the same room. The exam grade of each student would depend on one or two consecutive votes done in secrecy. The 1st vote is the unique vote mentioned in article 61 of the reform of Alexandre de Campos. The students that obtained the majority of favourable votes would pass the exam. The goal of the 2nd vote was to grade the passing examinees. The grade was obtained by doing the average of the three voted grades in a scale of 10 to 20.

Decree of 1868 – Changed the study plans but kept the examination procedure. The high-school course, lasting six years, was divided into two classes. The second class included the first three years and the first class included the last three. For that reason the high schools that taught the first and second classes were designated as high schools of the first and second order. The 1st order high schools were located in Lisbon, Oporto, Coimbra, Braga and Viseu, with all the privileges enjoyed previously by the 1st class high schools.

Decree of 1872 – Return to the old classification of high schools (1st and 2nd class.) The course of 1st class high schools, lasting 6 years, integrated the special course and the general course. The special course, identical to the course taught in 2nd class high schools, included the first four years and the general course included the last two. An interesting innovation: to enrol in the College of Medicine or in the College of Mathematics one would need the special course and exams in Mathematics and Drawing from the special course; to enrol in the College of Law or the College of Theology one would need the special course and exams in Latin and Philosophy from the general course.

The legislator of 1872 will be remembered in the history of our high school teaching as the forefather of the specialized courses regimen adopted nowadays in high schools.

Decree of 1880 – a) The high school course, also lasting six years, now includes the general course and complementary courses. The general course included the first four years and it was homogeneous throughout all the high schools, central and national. The complementary course in Humanities was exclusive to the central high schools (Lisbon, Oporto, and Coimbra) and to the ones in Braga, Viseu, Évora and Angra do Heroísmo. The complementary course in Sciences was available at the central high schools and the one in Funchal;

b) There were three types of exams: passing, completion, and singular. The passing exams of the 1st, 2nd, 3rd, and 5th years were required to enrol in the 2nd, 3rd, 4th, and 6th years, respectively. The passing exams of the 4th year, last year of the general course, and of the 6th, last year of the complementary courses, were required for the completion exams of the corresponding courses;

c) There were no organized topics for the oral tests which were comprised of two interrogation sessions per subject, per student. The topics for the written passing exams where written at each high school by the teachers of the subject for the corresponding year. A Government appointed committee of teachers organized the topics for the written completion exams, which were then approved by the CSIP (Conselho Superior de Instrucão Pública);

d) The jury for the passing exams was formed by all the teachers of the respective year and, if needed, one or two more for the oral test interrogations. The jury for the completion exams of the general course was formed by the headmaster and four voting members nominated by the School Council. The jury of the completion exams of the complementary courses was Government appointed and was formed by one Higher Education Professor, who presided, and four voting members (high school teachers or higher education professors);

e) The grading of the written tests (1st series tests) for any subject was done in a scale of 0 to 6, with the extremes corresponding to bad and very good, respectively. The voting was done by secret vote. Each voting member of the jury (there were just three: the two examining teachers and the senior amongst the remaining members of the jury) would register the grade he believed corresponded to the merits of the exam. If the examinee got at least two votes out of three each, he would then pass the exam. Calculating the average of the voted grades, ignoring fractions under 0.5 and counting as units the fractions equal or higher, would give the grade of the test. The same procedure was applied to the oral exams (2nd series tests.) In either the passing exams or the completion exams the examinee would not go through if he failed: 1.) in two or more 1st series tests; 2.) in two or more 2nd series tests; 3.) in one 1st series test and a 2nd series test.

The law was harsher for external examinees, who upon failing a single 1st or 2nd series test would fail the corresponding exam.

Decree of 1886 – a) “Uniform, equal and complete” course in all high schools, divided in classes: 1st class (1st and 2nd years); 2nd class (3rd and 4th); 3rd class, humanities (5th and 6th); 3rd class, sciences (5th and 6th). This reform appears to have been inspired more by the wish of “putting an end to local emulations” than by the superior interests of teaching. Aside from the unfair treatment given to the Drawing subject and the elimination of the Legislation subject, the high school course of 1886 is essentially the same as the course of the central high schools of 1880. In fact, the first two classes (four years) and the humanities and sciences courses (two years) match the general course and the complementary courses of the previous reform. It was a simple name change, a typical case of “legislation vitis” with no major consequences.

Article 26, on the other hand, had serious consequences by satisfying the wishes of some school councils and forbidding teachers and high school employees from private tutoring. These consequences, particularly nefarious for secondary teaching, were perhaps necessary to allow private teaching to achieve, in the long run, the prestige and dignity it holds nowadays. It was easy for this kind of teaching, without any restrictions, to get hold of the great majority of students.

Still, alongside good and very good private schools, truly mercenary teaching companies, scrupleless and with no competence, emerged throughout the country. Adventurers would arise from this pseudo-teaching come exam season and flock to the high schools where they believed they would find compassionate and non-demanding juries. One of the most chastised high schools was in Lamego, a school with a noble tradition. A piece from the newspaper «Progresso», which was published in that town at the time, reports on it in a humorous way: «Know this, adventurers, the high school of Lamego is not a meeting place for dumb people. »

It is true that after 1888 (article 9 of that same years decree), external students could only enrol for exam in the high school of the district or town where they studied for at least the last four months. The practical result was the demand of a new document to add to the exam petition: an ordinance authorizing it. Regarding the enrolment of a group of students from Trás-os-Montes to take their exams at the high school of Lamego, the following melancholic commentary appeared in the newspaper: «By allowing the ordinance the Government does what they can, not what they should.» And further ahead: «those who trust the high school of Lamego to take their exams, should first trust it to come here and study since in Lamego the teaching is competent, work is done with "unsurpassable zeal"».

The current state of affairs led to the alarming decay in the quality of teaching.

The first reaction was soon felt. Five years after the decree of 1886, Luciano Cordeiro, at that time interim Director-Geral da Instrução Secundária e Superior (Secondary and Higher Education Director), ordered that the Inspectors of the three school circles conducted a rigorous investigation of the life of the private teaching facilities, the qualifications and competence of the teachers, the hygiene and feeding regime of the board students, etc. Three years later the first statute, let us call it that, of Private Teaching in Portugal, included in the General Regulation of Secondary Instruction of August 14, 1895 was published;

b) Four kinds of exams: admission to high school, passing, class and singular. The passing exams, which always preceded the class exams, were composed of only oral tests. Those exams were not necessary for internal students that got an attendance grade of at least 10, and only students whose grade was not under 7 were allowed to take them. The class exams were composed of written exams on random topics and of oral exams with two interrogations of 15 minutes each. The written tests for Portuguese and Mathematics on the 2nd year where replaced with exercises on the board during the oral tests;

c) The topics for the written tests of the different subjects were written by the respective teacher;

d) The Government nominated the jury for class exams, formed by teachers of secondary schools and colleges. For the other exams the School Councils would nominate the jury;

e) The grading of the written and oral exams was done by secret vote.

Decree of 1888 – Each year formed a class with the first three years common to the general course (four years) and the humanities course, and the other two years common to the general course and the science course.

Same legislation regarding exams can be found in the applicable part.

Decree of 1895 – a) Reacts against teaching by subjects and replaces with class teaching. The high school course was, for the first time, seven years long and comprised three sections: lower (1st and 2nd class); middle (3rd, 4th and 5th) and higher (6th and 7th). The first two sections formed the general course and the latter the complementary course, exclusive to the central high schools;

b) Five kinds of exams: passing, completion of the general course and of the complementary course, admission to class, admission to subject, and singular. The passing exams, as well as the admission and completion exams, were composed of written and oral tests, the latter with a single interrogation per subject and the former about randomly drawn topics. The 1st class students did not take a passing exam; the ones that had at least a grade of satisfactory in all subjects during the last four months of the school year would move on to 2nd class. The students from 2nd, 3rd, 4th and 6th classes that had at least a grade of good on more than half the subjects and satisfactory on the remaining would not have to take these exams. The legislator gave great importance to the passing exams: «they operate, within reasonably tolerant limits, a healthy selection; they tend to properly even out the classes; they ensure the advantageous continuation of the studies and inform the families of the true intellectual worth of their children »;

c) In each high school the topics for the written tests of all the exams, 30 per subject, were written by the teachers of each subject and approved by the School Council;

d) The jury for the passing or class admission exams was formed by the teacher of the corresponding class and presided by the director of that class. The jury for the completion exams was formed by the teachers of the corresponding class and presided by a higher education professor. For the other exams, three teachers nominated by the headmaster formed the jury. An innovation: the president of the jury had the right of vetoing any vote he considered unfair or not conforming to the legal provisions;

e) Once a class finished the exams they would be graded by the examining voting members, this would be followed by a vote by subject, no longer in secrecy but in conference. In order to be allowed to take the oral exams, the examinee would have had to get a majority of satisfactory grades in the written tests. However, one was not allowed to have had a grade of bad in any of the remaining tests, and these could not include the tests in Portuguese, Latin and Mathematics. The examinee who had good as the majority of grades on each of the written tests, and had at least satisfactory as the majority of grades for each of the subjects on the class book, would be exempt from taking the oral tests.

The grading of the oral tests was also done in conference. In the case of the exams to pass, the examinee would pass a class if he got at least a majority of satisfactory grades in each of the oral exams, minus two, which could not be the tests of Portuguese, Latin or Mathematics. On the completion exams, to pass the examinee would have to achieve at least a vote of satisfactory on each subject.

Bill of Law of 1896 – Keeps the complementary course without bifurcation and eliminates the division of the general course in sections. The passing exams, so highly recommended by the organization of the previous year, were abolished. There were only the completion exams of the general course and of the complementary course.

Decree of 1905 – a) High school course divided into three sections: lower (1st, 2nd and 3rd classes); middle (4th and 5th); higher (6th e 7th). The higher section was exclusive to the central high schools and it was divided into two courses: complementary in Humanities and complementary in Sciences;

b) Six kinds of exams: of the general course, 1st section; of the general course, 2nd section; of the complementary course in Sciences, of the complementary course in Humanities, admission to class and singular. For the first there is no distinction between internal and external students on the organization of the exam roster, «all will be distributed alphabetically »;

c) The topics for the written tests were written at each high school by the teachers of each subject and approved by the School Council;

d) The jury of the exams of the general course, 1st section, was formed by all the teachers of the 3rd class and presided by the corresponding director. The teachers of the 5th class formed the jury for the exams of the general course, 2nd section, which was presided by a Government appointed higher education professor or a tenured teacher of a central high school. The teachers of the 7th class formed the jury for the complementary courses exams. Those exams were presided by a Government appointed higher education professor;

e) The tests were graded in conference. Students would not be admitted to the oral tests if they had an average grade on the written test lower than 6, for the general course, 1st section; lower than 8 for the general course, 2nd section; lower than 10 for any of the complementary courses. The examinees that achieved an average grade of at least 10 on the oral tests for each subject would pass. The examinee that failed a single subject would be allowed to take a singular exam on that subject two months later.

Decree of 1917 – a) Organizational plan of 1905, with slight changes. As an innovation, several subjects were excluded: Portuguese and Philosophy on the complementary course in Sciences, and Physical and Natural Sciences on the complementary course in Humanities;

b) The distinction between internal and external students is brought back. For the internal students, four kinds of exams: of the general course, 2nd section; of the complementary course in Humanities; of the complementary course in Sciences; and singular. The external students also had exams for the general course, 1st section, and admission to class;

c) In each high school and for each subject, the teacher council for that subject would organize at least ten topics for the written tests and the same amount for practical tests, if they existed. For each test the first student on the roster randomly selected the test;

d) For the internal students the jury for the exams of the general course, 2nd section, was formed by the teachers of the 5th class, presided by the corresponding director, if it was a central high school, or by a tenured high school teacher, nominated by the Government and not from the high school, if it was national. For the external students, the voting members of the jury were nominated by the School Council and they would be presided by a Government nominated higher education professor or teacher of the public Secondary School system. The president of the jury for the exams of both complementary courses was a Government appointed higher education professor or high school teacher; the voting members were 7th class teachers for the internal students, and designated by the School Council for the external students;

e) Once the written tests were finished the jury would meet to grade them in one or more sessions. The examining voting members recorded their proposed grades on the tests and then all the members of the jury would vote. The grade of each test was the average of all the votes. An examinee that got an average lower than 10 in two or more subjects would fail. Once the oral tests were completed and voted an examinee that got at least 10 on each subject would pass. The final grade was the average of the averages of the oral and written tests.

Decree de 1918 – The only noteworthy fact is the composition of the sections forming the general course. The 1st section now included the first two classes and the 2nd section, the following three. The passing exam into 2nd grade was compulsory for both internal and external students.

Regulation of 1921 – Eliminates the subjects of Portuguese and Philosophy from the 7th class of sciences and replaces the Physical and Natural Sciences on the complementary course in humanities with six hours of Mathematics in 6th class. Once again, and this time for good, there is no distinction between internal and external examinees. The topics for the written exams were created by the examiners of the respective subjects and approved by the juries during their preparatory meetings.

Decree of 1926 – Corrected in January of the following year, this organization does not offer any innovations worth of attention. Its most relevant characteristic: the six-year high school course did not survive.

Decree of 1931 – a) General course divided in two cycles, the first includes the first two classes and the second the following three. Complementary courses lasting two years;

b) The following exams were available to both internal and external students: of the general course, 1st cycle; of the general course; of the complementary courses. The external students also had: admission to class and singular;

c) The topics for the written tests were organized by the high school teachers in collaboration with the Secondary Teaching Section of the CSIP (Conselho Superior de Instrucão Pública);

d) The jury was nominated in each high school by the headmaster and it was presided by a Government appointed higher education professor or high school teacher;

e) The written and practical tests were graded by the jury of each exam in conference or by superiorly appointed examiners. Getting a grade lower than 10 in the majority of subjects, or lower than 8 in two or more, would result in failing. Students with at least 10 in every subject and an average not lower than 12 would be exempt from taking the oral tests.

Decree of 1936 – a) Condemns the distinction between general course and complementary courses, but that does not prevent this organization from considering a general course lasting six years, divided in two cycles, and a complementary course lasting one year (3rd cycle), divided in two semesters. It condemns the division of teaching in Humanities and Sciences but later on that division is re-established in 1941. It also condemns the class regime and intends to replace it with a subject regime, but does so in logical seriation through the years of the course and recommends a pedagogical coordination in each year, essential characteristics of that regime.

The innovation was simply the following: students that failed in one or two subjects could enrol, but in the year that didn't depend on those subjects. After 1943 this rule only concerned students that failed a single subject;

b) There were cycle and singular exams composed by two written tests per subject and an oral test for modern languages;

c) Same as the previous legislation. The regime of multiple tests was abolished, though;

d) The headmaster nominated the jury for all the exams;

e) The jury would choose the better of the two written tests. The student with a grade of at least 10 would pass.

Decree-Law of 1944 – Re-establishes the national exams system with both written and oral tests on each subject. In each high school the headmaster would nominate teachers who would write the tests.

Students' school performance was always bad and the number of students failing the exams was always extremely high. It got to the point that the Ministry of Education determined that written exam exclusions could not be over 30% of the total for each subject. This is how it was in 1939. The exams that exceeded this limitation were once again reviewed and graded as to satisfy that parameter, in which the students who had been previously approved also benefited (Carvalho, 2010, p. 343).

During the years before Pires de Lima Reform, the primary purpose of testing was the individual selection and diagnosis and, to lesser extent, evaluation of programs. Beginning in the 1950s, national exams took on a new role, that of monitoring the performance of the educational system.

2.2 An outline of exams legislation from 1947 to 2005

This five-decade period (1947-2005) witnessed major changes in national assessment: changes in the nature of the exams, the delineation of the tested populations, the reporting scores, and the use of test scores. The implementation of new forms of assessment can be interpreted and understood from a variety of perspectives. One way is through the analysis of legislation.

In the following legislation digest, the selection and interpretation of the most important High School and Technical Education legislation changes are supported by the analysis of certain aspects like study plans, structure and type of exams and their implementation.

Decree nr. 36,507, D.G. nr. 216, September 17, 1947 – High School educational reform of Fernando Andrade Pires de Lima. The urgent need for a reform of the high school teaching is acknowledged. The 1947 high school teaching reform brings back the curricular plans of before 1936. The General Course is now five years once again – 1st Cycle (two years,) followed by the 2nd Cycle (three years – with nine subjects), in a class regime, as it can be read on the preamble of point 11, "in the General Course the teaching regime cannot be class based, as mentioned before, meaning the coordination of all the several subjects to achieve general knowledge and preparation for life, independent of the kind of activity each student is destined to do." There are 24 weekly classes, four sessions and around six hours of Mocidade Portuguesa[3] activities. High school takes each student the same time as 34 classes, weekly. Female students still had to add two sessions of handicrafts (Almeida, 1955a). A student of the General Course would do written and oral exams in Physics and Chemistry (the student would be exempt from the oral exams if their average grade was equal or above 16) and he or she would be able to complete the 2nd cycle with one failing grade in each section (Humanities and Sciences,) although they would not be allowed to register for the 6th grade, as that was only possible for students with a single failing grade. The Complementary Course (two years,) that was split into "Humanities" and "Sciences," was based on a subject regime and had the Latin subject eliminated. The students of the 3rd cycle had to do practical, written, and oral tests as part of the Physics and Chemistry exam. They could repeat the exam for one subject in October. The study plan prescribed three weekly time slots for this subject, which was later expanded to four. The practical assignments were moved from the 2nd to the 3rd year, which led to a reduction from three to two years and

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[3] Portuguese Youth, was a government mandated youth organisation for all Portuguese youth between the ages of 7 and 14, and voluntary until the age of 25.

less practical assignments, with a single weekly time slot. There was an innovation on the practical exam, the random draw before the test, which would determine if the practical test was on Physics or Chemistry. This led to situations like the one of “a student who, by luck of the draw, had a Chemistry practical exam. The test was comprised of the identification of acids and bases, and neutralization. Ten minutes into the test, the student called me and asked if there was any chance of getting another test. When faced with a negative answer he stated he would quit as he had only studied the Physics practical assignments” (Carmo, 1960a). Note the following facts regarding the examination of external students: a) “doomed” students in public schools are allowed to transfer to private schools up until the end of the Easter holidays, with the possibility of applying to exam as external students; b) students are permitted to transfer between the different modes of private teaching which typically are only done from a school setting to private tutoring or home schooling, until the end of May; c) High Schools’ areas of influence are abolished, which allowed private schools to present their students to exam at any high school, as long as they had previously registered there the corresponding diplomas. “And thus the belief in miracles is encouraged: in less than two months, private schools transform students that had shown their inaptitude in public schools throughout the year in able students” (Soares, 1955). On the other hand, in the technical schools one could find courses in the Services, Feminine Education, Industry, and Arts. The legislation allowed a student that had passed the 2nd year of high school to do the preparatory cycle exam of the technical schools and enrol in its professional training courses (article 50.) At the same time, a student who had passed the 2nd year of the preparatory cycle of the technical schools could be admitted to the 1st cycle exam of High Schools (High School Statute, article 472) (Almeida, 1955b). The minister nominated every year a group of teachers amongst the most renowned to write the exams for the different subjects. When they were done, the tests were composed and printed under the most rigorous secrecy and unrelenting surveillance, and then distributed to all the High Schools in the country with the due care.

Decree nr. 36,508, D.G. nr. 216, September 17, 1947 – Statute of High School teaching.

Notice nr. 1,418, D.G. nr. 231, Series I, October 4, 1947 – In it the curricula for the subjects of the new General Course to be used in the school year of 1947-48 are published. It is stated that it was not possible to change the existing curricula but hopefully this would be done in the first half of the starting school year. On the other hand, the curricula from 1936 (DG nr. 27,085 from 14/10/1936) were still in place for the 6th and 7th grades. At the end of the 2nd cycle the national exams focused on the transitional curriculum, even though the students had not started the curriculum by the 3rd year and with late clarifications, as the one from February 7, 1948.

The transitional regime created the so-called “stuck” of the Pires de Lima Reform – the emancipated of-age students that having applied for the 2nd cycle exam (6th grade) in 1949, failed two or more subjects. Even more interesting than the clarification request (sent by the Liceu de Portalegre and found in book 31, nr. 345) is the fact that Notice nr. 1608, from September 16, 1949, is issued to solve the matter.

Notice nr. 1,452, D.G. nr. 296, Series I, December 22, 1947 – Clarifications to the transitory curriculum of the 3rd year of Physical and Chemical Sciences. This kind of clarification was only issued for this subject due to its complexity and specificity. It imposes a method of teaching based almost exclusively on experiments, with a minimal use of math, and very simple exercises, almost exclusively limited to “The Rule of Three.” In Physics, activities regarding movement and densities were deemed forbidden if they were not direct applications of the formulae taught in the curriculum. In Chemistry it is stated that one cannot go beyond the classification of chemical phenomena, and that the teaching of Chemistry should be, essentially, based on experiments and inductive learning. It is added that most of the time dedicated to Chemistry should be used in experimental demonstrations, so that the students could draw from them the appropriate conclusions.

Notice nr. 1,464, D.G. nr. 31, Series I, February 7, 1948 – Clarifications regarding the 4th and 5th grade curricula for Physical and Chemical Sciences. In it, the considerations of the previous notice are repeated due to the fact that the Physical-Chemical Sciences curricula for the 3rd and 4th grades are completely new, and also due to the adaptation to the constitution of the current 2nd cycle. Another critique was the lack of coordination between the teaching of Physics and Mathematics in the 3rd cycle – “Faced with the incoordination of these two subjects, how can a Physics teacher demand that the student solves certain exercises that require the application of the mentioned knowledge?” (Carmo, 1960b), a situation that stayed unchanged up until 2005!

Decree nr. 37,029, D.G. nr. 198, August 25, 1948 – Reform of the Industrial and Commercial Professional Teaching. Some examples of these courses are: Training Course for Metal Workers; Electricians; Carpenters and Woodworkers; Ceramists; Feminine Education Course (lasting four or three years, depending on the acceptance or not for Primary Teaching, Embroidery;) Commerce General Course; Preparatory Sections for the Industrial and Commercial Institutes; Specialization Courses in Automobile Mechanics, Construction Draftsman and Seamstress. These courses did not have direct access to University, the graduates were technicians and their working life waited. Later on, articles 307 and 325 were altered respectively by the decrees 37,212, D.G. nr. 288, December 13, 1948, and 37,223, D.G. nr. 294, December 20, 1948.

Decree nr. 37,112, D.G. nr. 241, Series I, October 22, 1948 – New curricula for High School teaching, General and Complementary Courses, introducing simplifications that allow the curricula to adapt to the receptive capacity of the students, and to show not what they should learn but what they could learn at the age they attended the first five years of High School. It was enforced on October 1, 1950, keeping the 1936 curricula for the subjects in the transitory regime.

Decree nr. 39,807, D.G. nr. 198, Series I, September 7, 1954 – Changes to the new High School curricula, and indication of the official textbooks. In the Physical-Chemical Sciences specifically, these changes attempted to address the disagreement expressed by several teachers at the time of the annual reports (Teachers Reports, DGEL Found, AHME, nº 2086 (1947/1948), box nº 2/101; nº 1860 (1947/1948), box nº 2/107; nº 1876 (1950/1951), box nº12/621; nº 1877(1951/1952), box nº 14/758) or in magazines such as *Labor* (Teixeira, 1951c), due to the extension of the curricula, especially on the 5th grade of Physics, as well as in 7th grade of Physics and Chemistry. There were also several condemnations due to the existence of only seventeen compulsory Physics assignments (eight in the 6th grade and nine in the 7th grade) (Carmo, 1959).

Decree nr. 41,192, D.G. nr. 162, Series I, July 18, 1957 – Besides regulating the enrolment of students in the several modes of private teaching, it allows the execution of national exams in private institutions with the appropriate ministerial authorization. Upon analysing the exam roster of a Lisbon high school one will notice that the majority of students coming from private schools failed the practical exam due to lack of preparation, no knowledge of the labs, and being in the presence of unfamiliar teachers. On the other hand, there was a lot of criticism regarding the design of the national exams (Almeida, 1952).

Ministerial Order from August 17, 1963 – This order enforced the following rules for the writing of the topics for the High School or High School Admission Written Exams:

a) considering the proposal of the High School Teaching Inspection, every year the Minister will appoint two teachers for each group, of which one is a methodologist, meant to be in charge of the preparation of the topics for the exam;

b) The non-methodologist teachers will do a project of topics to be delivered to the methodologist teachers who in turn create a supported written opinion, and propose all the changes deemed necessary;

c) The project and the proposed changes, along with the corresponding written opinion, are studied by the Inspection. They will then be the subjects of a discussion, in one or more meetings where the presiding Head-Inspector, the Inspector of the corresponding or similar group, and the two teachers will take part. The final decision is the responsibility of the Inspection. In the topics aimed at the High School admission exams a Primary Teaching Inspector, nominated by the appropriate General Directorate, will also be involved;

d) The whole process of writing topics should be done in a cautious and ponderate manner so that they absolutely respect the letter and spirit of the law, namely articles 263, nr. 1, 485, and 486 of the Statute of High School teaching, and the instructions that might be issued with ministerial approval. The methodologist teacher, upon receiving the topics, should answer them as if he was an examinee, and in his written opinion should note the conclusions from this experience, taking into account the obvious difference in constraints, namely the time it takes;

e) The review of the typographical proofs will be done with the same ponderation and caution, as stated in the article 482 of the Statute, by the teachers on duty, according to what is stated in the article 176, nr. 1 and 2, of the same Statute, under the oversight and responsibility of the High School Teaching Inspector that participated in the appreciation of those points; f) The schedule will be announced in a timely manner, following the proposal of the High School Teaching Inspection; g) The teachers in charge of the topic preparation will have a copy of this Ministerial Order and of the instructions mentioned above in point d) (Ministério da Educação Nacional, 1963).

Decree nr. 46,136, D.G. nr. 305, Series I, December 31, 1964, p. 1972 – Creates, in a dependence of the Instituto de Meios Audiovisuais do Ensino (IMAE, Institute of Audiovisual Media for Teaching,) a Tele-school aimed at broadcasting radio and television school courses. The educational part of the original program established that the televised teaching should follow an equivalent curriculum to the preparatory cycle of technical teaching, with the addition of French.

Ordinance nr. 21,112, D.G. nr. 40, Series I, February 17, 1965, p. 187 – Determines that Tele-school, created by Decree nr. 46,136, offers a support course for the adult education courses.

Ordinance nr. 21,358, June 26, 1965, Series I, nr. 140, p. 874 MEN – Designates as "Comprehensive Tele-school Course," to be taught in tele-school and followed up in reception posts, the course formed by the subjects included in the preparatory cycle of the technical-professional teaching, with the addition of French, as established in Ordinance nr. 21,113.

Ordinance nr. 22,113, July 12, 1966, Series I, nr. 160, p. 1244 – Introduces changes to the Comprehensive Tele-school Course regime, created by Ordinance nr. 21,113, in accordance with what is determined in Decrees nr. 46,135 and 46,136.

Decree nr. 47,480, January 2, 1967, Series I, nr. 1, p. 1 – Creates the preparatory cycle of secondary education, which replaces both the 1st cycle of High School and the preparatory cycle of technical-professional teaching. The Preparatory Cycle of Secondary Education is two-years long (5th and 6th class) and is common to both high schools and technical schools. The admission exams (to high schools and technical schools) are eliminated, allowing the expansion of all secondary education. The two modes now have identical structures but remain as two separate paths. In high schools there were little changes. Technical schools, on the other hand, went through a true revolution: the general courses are now reduced to three years, and two-year long complementary technical courses are created, similar to the high school complementary courses. They were composed of five subject sets formed by the following subjects (the weekly load in hours is indicated in parenthesis): set A – Native Language (5), History and Geography (3), and Moral and Religion (2); set B – Mathematics (3), and Natural Sciences (3); set C – Drawing (3), and Handicrafts (2); set D –Musical Education (2), and Physical Education (2); set E – French or English (3). Passing the 2nd year of the preparatory cycle allows enrolment in either High School or in a Technical-Professional School, per the terms determined by each of these paths.

Ordinance nr. 22,643, April 21, 1967, Series I nr. 95, p. 781 – Establishes the final exam regime for the Comprehensive Tele-school Course. The final exams would happen in a single season and comprised of written and oral exams in Native Language and French and written exams in National History, Geographic and Natural Sciences, and Mathematics. The exams were graded by a single jury, in conference, presided by the Director of Tele-school and comprised of Tele-school teachers. The final grade was calculated through arithmetic average.

Decree nr. 48,038, November 16, 1967, Series I, nr. 267, p. 2019 – Changes the writing of article 4 of Decree nr. 36,507 establishing the high school education reform, launching the study plan for the 1st cycle.

Decree nr. 48,572, D.G. nr. 213 Supplement, Series I, September 9, 1968, p. 1343 – Approves the Statute of the Preparatory Cycle of Secondary Education and, in Ordinance nr. 23,601, from September 9, 1968, the curricula for several subjects are published. Ordinance nr. 23,600 creates the preparatory schools of secondary education, determines the denomination and roster of the faculty, administrative and minor staff for those schools, and defines certain special provisionally applicable regimes in the first phase of operation.

Presidency of the Council, D.G. nr. 27, Series I, February 1, 1969, p. 113 – Declaration of rectification of the Statute of the Preparatory Cycle of Secondary Education, approved by Decree nr. 48,572, so that the final grade is the rounded average of the term grades.

Decree nr. 49,067, D.G. nr. 142, Series I, June 19, 1969, p. 692 – Introduces instructions aimed at changing the doctrine of article 11, and nr. 1 and 2 of article 15 of Decree nr. 40,591 that changes the services of High School exams. It basically granted exemption from oral exams for any 3rd year subject to examinees that had a grade of at least 14 on the written exam. On the other hand, students of the 2nd cycle who passed both sections but with an average lower than 9.5 in a subject would be able to proceed with their studies, as long as that average didn't apply both to Portuguese and Mathematics subjects. The indicated average results from the grades of the written and oral exams for each subject.

Ordinance nr. 24,155, D.G. nr. 153, Series I, July 2, 1969, p. 780 – Creates the transition exams in the preparatory cycle of secondary education aimed at those students that had undergone studies of any nature, in Portugal or abroad, which the law did not consider equivalent to the ones in this cycle and wished to enrol in it.

Decree nr. 49,117, D.G. nr. 160, Series I, July 10, 1969, p. 824 – Introduces changes to article 554 of Decree nr. 36,508 that approves the Statute of High School Teaching. With a single article, it allowed the National Board of Education to have powers to establish the equivalence of knowledge obtained in any given Portuguese school to any year or High School major, to allow students to continue their studies.

Decree nr. 49,258, D.G. nr. 224, Series I, September 24, 1969, p. 1290 – Introduces changes to articles 482 and 484 of Decree nr. 37,029, which establish the Statue of Industrial and Commercial Professional Teaching.

Decree nr. 28, D.G. nr. 12, Series I, January 15, 1970, p. 73 – Presents some changes to the technical and professional teaching regulations, to point 2 of article 149 of Decree nr. 37,029, and to article 3 of Decree nr. 47,592.

Decree nr. 303, D.G. nr. 149, Series I, June 29, 1970, p. 843 – Introduces changes in regulations regarding the candidates to teaching positions in all three branches of secondary education.

Decree nr. 439, D.G. nr. 215, Series I, September 16, 1970, p. 1326 – Simplifies the admission exams to industrial and commercial institutes taken by applicants that have the required school qualification. The exams, for each subject, consisted of a written test and the examinees would pass if they achieved, considering all the exams, an average grade of 10 and had no grades under 8.

Decree nr. 555, D.G. nr. 264, Series I, November 13, 1970, p. 1709 – Changes point nr. 2 of article 93 of Decree nr. 36,508, from September 17, 1947, which approved the Statute of High School Teaching.

Law nr. 5, D.G. nr. 173, Series I, July 25, 1973, p. 1315 – Reform of Veiga Simão. In it the basics that should rule the reform of the educational system are defined, and its goal is to democratize learning. Still, due to the restraints consequent of the ruling regime, its only remaining merit was that it initiated the education mobilization process of the 1970s (Stöer, 1986, p. 259). The main innovations were: creation of an official Pre-school Education; lowering of the entering age for primary school; extension of compulsory schooling to eight years (the compulsory basic schooling was comprised by primary and preparatory schools lasting four years each;) changes to secondary education, adding a year to it; creation of post-graduate courses and structuring of continuing education. School grading is now done at the end of each phase, eliminating the possibility of failing at the end of the 1st or 3rd grade. The 5th and 6th grades, integrated in compulsory schooling, are organized in three branches (primary complementary cycle, direct preparatory teaching, and TV preparatory teaching.) All contribute to broaden the student body, as many had serious economic difficulties, and to make use of the available resources.

From 1974 there were no more admission exams to Higher Education. This situation did not deserve, in due time, any position from this Minister regarding its pedagogical value or its social-cultural repercussions, and only in May 30th will there be a decree setting the access conditions to Higher Education.

The main measures taken after the Revolution of April 25th 1974 regarding Education were: a) the elimination of the subject of Political and Administrative Organization of the Nation, with political contents from the previous regime, and replaced it with Introduction to Politics; b) the extinction of the commercial and industrial education associated with a model set on the reproduction of social inequalities; c) unification of secondary education; d) “introduction of an interdisciplinary area of Civic and Polytechnic Education in the curricula of the comprehensive education and of the Student Civic Service as a condition to access university” (Mendes, 2004).

Decree nr. 270, D.G. nr. 124, Series I, May 30, 1975, p. 752 – Creates a national service named “Student Civic Service.” It was a vestibular year for admission to college; it consisted of community service activities with the goal of creating socially productive work habits in the students in a global program to rebuild the country.

“Supposedly in effect for three school years, the Student Civic Service actually just happened in the 1974/5 and 1975/6 school years. It was completed, in its Year One, when it was optional, by 8,758 students, and in its Year Two, when it was compulsory, by less than 11,814 students. The path of the Student Civic Service expresses the combination of material, resource and idea constraints in the field of social experimentation as well as the rhythms and contradictions of the democratization process in Portugal” (L. Oliveira, 2004, p. 2).

Ordinance nr. 535, D.G. nr. 202, Series I, September 2, 1975 – Defines the courses and syllabi to be taught in secondary schools. The 1st General Comprehensive Course is created, formed by the 7th, 8th, and 9th grades of compulsory schooling. It unifies the high school and technical paths and presents a common branch in the first two. Besides the common branch, the 9th grade includes a vocational area formed of groups of optional pre-vocational subjects.

Decree nr. 127, D.R. nr. 36, Series I, February 12, 1976 – Keeps the Ministério da Educação e Investigação Científica, (MEIC, Ministry of Education and Scientific Research) as the superior authority responsible for the Student Civic Service in the school year of 1975-76. Later on there were some changes to the Student Civic Service: in Decree nr. 270/75, from May 30, and in Decree nr. 455/76, from June 8, D.R. 134, as a way to supply students enrolled in the Student Civic Service with a stipend to cover basic needs of food, lodging and transportation, as well as in Decree nr. 536/76, July 8, D.R. 158, which imposes the approval of the disciplinary statute of the Student Civic Service, according to an ordinance from MEIC.

The access grade to higher education was calculated as follows: 50% was the grade of the scientific and cultural level university access exam and the remaining 50% were divided into 5 parts regarding the General Course and Complementary Course of secondary education grades and also the exam grades of two core subjects.

The terms of access to higher education imposed, in addition to enrolment in the Student Civic Service, the following:

a) A passing grade in six subjects of the High School Complementary Course, of which two had to be the core subjects corresponding to the exams to be taken; or to have passed the Complementary Course of the Technical Secondary Education appropriate for the degree they wished to attend, according to the table attached to Dispatch n. 14/76 from the Secretary of State for Higher Education, published in the 2nd Series of the Diário da República (Diary of the Republic) n. 221 from September 20, 1967;

b) A passing grade on the higher education access exams. These exams included a Portuguese test and a test for assessing the scientific and cultural level of the candidates, with two written tests, each dealing with one of the core subjects that could be: Natural Sciences, English, History, Latin, Mathematics, German, Physical- Chemical Sciences, Drawing, Philosophy, Geography, Portuguese, and French. There were no oral exams and the written exams took 120 minutes, with the exception of the Drawing exam which lasted 180 minutes;

c) The elaboration of the tests was based on a structure with optional questions since the syllabi taught to the examinees were different and the secondary qualifications, although equivalent, could differ;

d) The written exams taken between July 27 and 30, 1977 were graded by a national jury formed by an ensemble of teachers selected by the public schools. The grades were made public two months later at the schools in the district capitals where the examinees took their exams;

e) The examinees could not have a grade lower than 10 in the Portuguese exam in order to apply to higher education. Achieving a grade above 10, either in the Portuguese exam or the scientific and cultural level assessing exam did not automatically guarantee admission to higher education.

Decree nr. 397, D.R. nr. 216, September 17, 1977 – Regulates admission to college, in accordance to the legal rules of the official college admissions in the school year of 1977/78, mentioned in ordinances 81/77 (published in Series II of DR (Diary of the Republic) on March 8) and 127/77 (published in Series II of DR (Diary of the Republic) on May 17).

Decree nr. 491, D.R. nr. 271, November 23, 1977 – Starting on the 1977-78 school year, it nationally implements the Propaedeutic Year. The Propaedeutic Year was composed of five subjects, two of which are compulsory (Portuguese and a foreign language). “The announcement of the creation of the Propaedeutic Year followed a campaign launched by several political forces in mid-1976 against the Student Civic Service, at the time considered by those political forces as an appeal and a swindle” (Redacção, 1977, p. 10).

This Decree sets a five subject study plan for access to each major in higher education: a) Portuguese; b) two nuclear subjects for each major; c) a subject complementary to the nuclear subjects, deemed essential to the education of the student; d) an optional subject corresponding to one foreign language. Portuguese is replaced by one of the subjects mentioned in point c) for the students that have Portuguese as a nuclear subject. For the students that have the optional foreign language subjects as nuclear, the subject in point d) is replaced by another complementary subject.

Attending the Propaedeutic Year and passing all the subjects were requirements to enrol in public higher education. Only students that had completed the complementary course of secondary school or had an appropriate official equivalent, according to the law, could enrol in the Propaedeutic Year. However, candidates missing a single subject to complete the complementary course of secondary school would be allowed to enrol. The Conselho Orientador (Guidance Council) and the Comissão Pedagógico-Científica (Scientific and Pedagogical Commission) assured the organization and operation of the Propaedeutic Year, the logistic and administrative support was provided by the Serviço de Apoio ao Ano Propedêutico (SAAP, Propaedeutic Year Support Service).

The Propaedeutic Year brought to light some of the shortcomings of our educational system. Over 27,000 students suffered from the bad reception, in several regions, of the programs broadcast by the second channel of RTP, and added trouble with some subjects particularly hard to be taught at a distance (mainly Drawing). The final results showed that of the 27,000 enrolled students, only around 4,500 passed (Redacção, 1978, p. 10). Since there were 12,000 open spots for higher education, there was a second round where all the students that fulfilled the following criteria were approved:

- A total of 32 in the sum of the grades achieved in the four exams of the core subjects or in the sum of the grades achieved in the exams of the subjects to be indicated in point 2;

- A grade of 4 on each exam for every subject the examinee was enrolled for;

- A grade of 10 in the sum divided by two of the average grade of the Propaedeutic and complementary cycle subjects (NAP+ MDN).

Numerus Clausus (which will determine each year how many students are allowed to enrol in the 1st year of each college degree) are also introduced that year through *Ordinance nr. 634-A, D.R. nº 230 – Supplement, October 4, 1977*.

Normative Order nr. 140-A, D.R. nr. 141 – Supplement, June 22, 1978 – Defines the structure and determines the curriculum of the complementary courses for the 1978-1979 school year. The 8th and 9th grade of the Comprehensive General Course are created as part of secondary education. The complementary course of the unified teaching is organized in five study areas, which integrate a common branch of subjects, a component of specialized training, and a component of vocational training. The complementary course (10th and 11th grades), created in continuity of the general course, essentially aimed to ensure vocational training in the chosen area as a continuation of education. Some changes are added later on, through *Ordinance nr. 400/78, from July 21, D.R. nr. 166*, and in *Normative Order nr. 168/78, from July 31, D.R. nr. 174.*

Ordinance nr. 333, D.R. nr. 141, June 22, 1978 – Aims to adapt the regime for knowledge assessment on the Propaedeutic Year to the specific situation of students residing in Macau.

Ordinance nr. 660, D.R. nr. 262, November 14, 1978 – Exceptionally establishes new conditions to pass students who, in the school year of 1977-1978, took exams of the Propaedeutic Year, and sets the terms in which they will be admitted for enrolment in college.

Ordinance nr. 455, D.R. nr. 193, August 22, 1979, p. 2044 – Creates a supplemental exam season for the Propaedeutic Year (appeal season).

Ordinance nr. 572, D.R. nr. 252 Supplement, October 31, 1979, p. 2774 – Approves the curricula for primary and preparatory education, and for the 7th and 8th grades of the secondary general course.

Ordinance nr. 128, D.R. nr. 71, March 25, 1980 – Establishes regulations regarding *ad hoc* exams to obtain credit for other studies.

Decree nr. 240, D.R. nr. 165, July 19, 1980 – Following *Ordinance nr. 414, D.R. nr. 184, August 10, 1979, p. 1875*, this Decree creates the 12th grade and eliminates the Propaedeutic Year. The 12th grade was created with the goal of being both the ending cycle of High School and a vestibular year for college education application. It is structured in two paths: the academic path, aimed at college application, and the professional path, which will also be appropriate for application to a superior polytechnic school.

Ordinance nr. 537, D.R. nr. 191, August 29, 1980 – Revokes point 6 of *Ordinance nr. 455/79*, from July 26 (Propaedeutic Year exams).

Ordinance nr. 559, D.R. nr. 203, September 3, 1980 – Establishes the terms of access to college as well as the rules for the application, enrolment and placement in college for all the students who have the appropriate requisites.

Ordinance nr. 578, D.R. nr. 206, September 6, 1980 – Determines the number of available spots for application to enrolment in the first year of college for the school year of 1980-1981 (*numerus clausus*.)

Ordinance nr. 799, D.R. nr. 232, October 7, 1980 – Exceptionally passes, in the Propaedeutic Year, students that only satisfied the minimum passing requirement for the nuclear and complementary subjects of a set, for college access.

Ordinance nr. 928, D.R. nr. 254, November 4, 1980 – Establishes precedence between high school complementary course subjects and 12th grade subjects.

Ordinance nr. 520, D.R. nr. 114, June 26, 1981 – Establishes the terms of access to college as well as the rules for the application, enrolment and placement in college. It will be changed later by *Ordinance nr. 811/81, D.R. nr. 215, from September 18, 1981.*

Ordinance nr. 684, D.R. nr. 183, August 11, 1981 – Establishes rules regarding the general structure and access conditions to 12th grade. There was a high failing percentage in 11th and 12th grades during the 1980/1981 school year, even after the change in the grading criteria for the 11th grade exams. In the Physics exam, 1st call of 12th grade, there were around 53% of failing students. (Rosado, 1982, p. 4) This Ordinance would later on be changed by *Ordinance nr. 824/82, from August 30, D.R. nr. 200, p. 254,* which introduced rules for application and enrolment in colleges, regarding students with special conditions.

Ordinance nr. 825, D.R. nr. 200, August 30, 1982, p. 2547 – Changes Appendixes I and II of *Ordinance nr. 530/82, from May 28,* which regulates the terms of application to enrolment in college. It also regulates the terms for re-entry, changing majors, and transfer between colleges.

Normative Order nr. 194-A, D.R. nr. 243, Series I, October 21, 1983 – Creates technical-professional and professional courses to be taught after the 9th grade and sets organization and operation standards for those courses. These courses lasted three years, corresponding to the 10th, 11th, and 12th grade, and they offered a secondary studies completion diploma, which allowed continuing studies in college, and technical-professional training diplomas to start their working life. There are now four different types of courses in secondary school: General Courses (academic ;) Technical-Professional Courses (10th, 11th and 12th grade ;) Professional Courses (10th grade followed by an internship ;) High School and Technical Complementary

Courses, for night school (10th and 11th grade.) This restructuring also includes the teaching of arts, namely music, dance, theatre, and cinema, in the general modes of the basic, secondary, and superior schooling. There is an increase of this offer until the year 2000 in secondary education, not only in the General Courses (group 2 – ARTS,) but also in the courses of the Specialized Artistic Teaching, Technological Courses, Professional Courses, and in the Recurrent Education Courses. As a complement to the ’83 legislation, through order 23/ME/1983, it eliminates exams for students of the public schools but keeps them for students of private and cooperative schools enrolled in institutions with no pedagogical connection. The continuous grading extends to the secondary school with the school taking charge of the definition and execution of the internal control mechanisms. The government is responsible for the external validation of those mechanisms. Actually, a lot changed in a very short period of time both in schools and their organization, and in their own evaluation, all this without a corresponding coherent strategy (Jorge, 1996).

Ordinance nr. 21, D.R. nr. 11, January 13, 1984, p. 120 – Adds a point c) to nr. 2 of article 3 of Ordinance nr. 429/80, from July 24, defining regulations regarding extraordinary exams to determine the capacity to enrol in college.

Ordinance nr. 262/84, from April 24, was published later on and regulated access to higher education and application to the assessment exam.

Students that completed the 12th grade with a passing grade in the continuous grading regime in 1982-1983 or 1983-1984 had to take national written assessment exams. For internal students the grade (G) in each subject was the average of the assessment exam and 3rd term grades, rounded to the unit. If they were not internal students or had cancelled their enrolment, the grade in the assessment exam would be the grade of the subject. These and other rules imposed from 1983-1984 onwards for the 12th grade exam are explained in detail on Teodoro, Teodoro & Fernandes (1984, p. 127).

Normative Order nr. 71, D.R. nr. 192, August 22, 1986 – Defines an adjustment of the workload of the complementary courses of secondary school for the school year of 1986-1987.

Law nr. 46, D.R. nr. 237, Series I, October 14, 1986 – Basic Law of the Educational System – This publication determined the structural reorganization of the educational system, leading to the extension of compulsory schooling from six to nine years, and the consequent reduction of secondary education to three years. This Law led to an Educational Reform. In it a universal basic school, compulsory and free, with the duration of nine years, comprised of three sequential cycles, is defined. This meant that the 7th, 8th, and 9th grades form the third cycle of this system. Law nr. 115/97, from September 19, and Decree nr. 286/89, from August 29, later on altered it and defined a curricular reform for the basic and secondary schools starting in the 1989/90 school year. In the 1996/97 school year, fed what was learnt in the meantime, a project of participatory reflexion on the curricula of basic school is started and leads to the a guiding document to a Curricular Reorganization that would be executed in 2001-2002 for the 1st and 2nd cycles, and in 2002-2003 for the 3rd cycle (Beato, 2003).

Ordinance nr. 614, D.R. nr. 204, Series I, September 3, 1988 – Changes Ordinance nr. 429/80, from July 24, which regulates the extraordinary exams to determine the capacity to enrol in college.

Decree nr. 354, D.R. nr. 236, Series I, October 12, 1988 – Defines the general principles of access to higher education.

Decree nr. 286, D.R. nr. 198, Series I, August 29, 1989 – Approves the curricular plans for the basic and secondary cycles. A new organization of the secondary schooling appears with the Secondary Courses Mainly Aimed at Continuing Studies (CSPOPE) and Secondary Courses Mainly Aimed at Working Life (CSPOVA,) commonly known as technological courses. Fifty new professional schools are created, promoted by 95 different entities, to support this new organization. The total number of enrolled students is 2,688 for the 1989/1990 school year. Recurring Teaching is also created.

Ordinance nr. 421, D.R. nr. 133, Series I, June 9, 1990 **–** Introduces an exceptional bonus aimed at applicants that were not placed in previous years, in the 1990 university application procedure.

Ordinance nr. 1160, D.R. nr. 275, Series I, November 28, 1990 – Regulates the enrolment for the 1991 general knowledge assessment exam for college application and its execution.

Ordinance nr. 18, D.R. nr. 7, Series I-B, January 9, 1991 – Regulates point 3 of article 6 of Law nr. 46/86, from October 14 (Basic Law of the Educational System).

Ordinance nr. 466, D.R. nr. 124, Series I-B, May 31, 1991 – Creates a 2nd call in the special season of the general knowledge assessment exam for college application. Changes Ordinance nr. 1160/90, from November 28.

Ordinance nr. 476, D.R. nr. 126, Series I-B, June 3, 1991 – Approves the Regulation for the Review of the General Knowledge Assessment Exam for College Application in 1991.

Decree nr. 379, D.R. nr. 232, Series I-A, October 9 1991 **–** Changes Decree nr. 354/88, from October 12, which instituted the new regime for college access.

Normative Order nr. 98-A/92, D.R. nr. 140, Series I-B, June 20 1992 – Revokes Order nr. 162/ME/91, from September 9, published in DR (Diary of the Republic,) 2nd Series, nr. 244, from October 23, 1991, regulating the grading of students of the basic cycle and separating the legislation referring to the secondary cycle (Boavida & Barreira, 1992). The evaluation of basic and secondary education became different after the publication of Order nr. 98-A/92, based on a common norm, of Order nr. 162/ME/91. This order was in place for nine years and three days and its great acceptance was due to its design based in the cognitive psychology of learning and supported by a formative conception of grading, giving complete autonomy to teachers and schools in matters of grading the students' learning. It would be altered through Order nr. 30/2001, from June 22, where it is stated that, with the necessary changes and improvements, the same principles and orientations of its predecessor. Actually, in Order 98-A/92, the grading of the students of the basic cycle is a necessity derived from the principles and goals defined for this learning level in article of Law nr. 46/86, from October 14, Basic Law of the Educational System, which allows to assess, at each moment, their level of achievement. Among those principles and objectives, and regarding which grading system to adopt, the universality, obligation, and gratuity of basic school, the responsibility of ensuring a general education, common to all Portuguese, and the creation of an environment that promotes growth and academic success to all students, should be highlighted.

Ordinance nr. 341, D.R. nr. 87, Series I-B, April 13, 1992 – Changes the Regulation for the Review of the General Knowledge Assessment Exam for College Application in 1992, approved by Ordinance nr. 1171/91, of November 15.

Ordinance nr. 8, D.R. nr. 3, Series I-B, January 5, 1993 – Defines the list of specific exams for college application in 1993.

Ordinance nr. 243, D.R. nr. 49, Series I-B, 2nd Supplement, February 27, 1993 – Introduces some additions to Ordinance nr. 1017/92, from October 29, (sets the subjects and curricula of the assessment exams to be undertaken by college applicants in 1993).

Ordinance nr. 266-A, D.R. nr. 58, Series I-B, 2nd Supplement, March 10, 1993 – Approves the Regulation of the Assessment Exam to be undertaken by the 1993 college applicants.

Ordinance nr. 704, D.R. nr. 176, Series I-B, July 29, 1993 – Amends Ordinance nr. 8/93, from January 5, which approved the list of specific exams for college application in 1993.

Normative Order nr. 338, D.R. nr. 247, Series I-B, October 21, 1993 – Approves the grading regime for secondary school students. Establishes external grading through exams at the end of secondary school, affecting the students' final grade, certification, and access to college and the external grading can also be influenced by assessment exams whenever deemed necessary. The national exams at the end of secondary school allowed for external grading for the first time in approximately 20 years. On the other hand, assessment exams were only regulated in 2000 through Order nr. 5437/2000, from February 18, in which the subjects, the school years, and the application years of the exams are defined. These exams included all students and were progressively rolled out to students of the 4th, 6th, and 9th years, following a schedule that extended to the 2001/2002 school year.

Ordinance nr. 1222, D.R. nr. 273, Series I-B, November 22, 1993 – Defines the subjects and curricula for the assessment exams to be undertaken by college applicants in 1994.

Ordinance nr. 200, D.R. nr. 80, Series I-B, April 6, 1994 – Approves the list of specific exams for the school year of 1994.

Normative Order nr. 644-A, D.R. nr. 214, Series I-B, September 15, 1994 – This Order made some amendments to Order 98-A/92 regarding internal grading to "induce higher equity, justice, and accuracy in grading the students" (p. 5556-2.) There is a clear attempt to standardize the criteria for student retention as a way to attenuate the grading divergences verified between schools, the 9th grade sees the introduction of global exams (Barreira, 2001). Others considered that the announced measures were more than simple "adjustments" to Normative Order nr. 98-A/92, instead they were "(...) structural changes that could hurt or pervert fundamental vectors of the model and consequently its global philosophy" (Machado, 1994, p. 45).

The global exams are created. The schools were entirely responsible for them and they weigh 1/3 of the final grade of the 3rd term of the 9th grade. This way, students that in 1995/1996 and 1996/1997 attended the 8th and the 9th grades, respectively, would have to do global written exams as a part of their internal grading.

The 8th grade students would only do the Natural Sciences exam. There were no amendments regarding the assessment exams. The grading and curriculum development were completely under the control of both teachers and schools.

Ordinance nr. 254, D.R. nr. 161, Series I-B, July 13, 1996 – Sets and publishes the institution/major pairs and vacancies for the national application process for the public colleges for enrolment in the 1996-1997 school year as referred in point 1 of article 21 of Decree nr. 28-B/96, from April 4.

Ordinance nr. 254-A, D.R. nr. 161, Series I-B, 1st Supplement, July 13, 1996 – Amends appendix I of the Regulation of the National Application Process to the Public University System for Enrolment in the 1996-1997 School Year, approved by Ordinance nr. 241/96, from July 4.

Normative Order nr. 24-D, D.R. nr. 161, Series I-B, 1st Supplement, July 13,1996 – Sets for the 1995-1996 school year an exceptional regime for the publication of the final grades of secondary school for subjects that require a national final exam (adds two points to all final grades).

Normative Order nr. 45, D.R. nr. 253, Series I-B, October 31, 1996 – Amends Normative Order nr. 338/93, from October 21 (approves the grading regime for secondary school students).

Normative Order nr. 12, D.R. nr. 55, Series I-B, March 6, 1997 – Approves the Regulation for Secondary School Exams – general courses and technological courses.

The national exams for the 12th grade were compulsory for internal and external students, and for self-proposed candidates, and consisted of the final subjects of the 12th grade, according to the general and specific education components. The exam grade was shown as the achieved grade rounded to the unit and internal students would pass if they achieved a grade of at least 10, calculated according to what is determined in point 42 of Normative Order nr. 338/93, from October 21, and in Normative Order nr. 45/96, from October 9. It also revokes Normative Orders nr. 55/95, from September 19, and nr. 20/96, from May 21.

Decree nr. 229, D.R. nr. 200, Series I-A, August 30, 1997 – Creates the Gabinete de Avaliação Educacional (GAVE - Office of Educational Assessment), the institution in charge of the preparation and evaluation of the national exams. Its competences are mainly the external assessment of the students' learning and knowledge, and the moments of planning, conceptualizing, coordination, preparation, validation, and the application and control of the respective instruments.

Law nr. 115, D.R. nr. 217, Series I-A, September 19, 1997 – Amendments to Law nr. 46/86, from October 14, (Basic Law of the Educational System.)

Ordinance nr. 138, D.R. nr. 53, Series I-B, March 4, 1998 – Sets the list of specific subjects and of national exams to be used as specific exams for application to college in the 1998-1999 school year.

Normative Order nr. 16, D.R. nr. 61, Series I-B, March 13, 1998 – Approves the Regulation of Secondary School Exams (General Courses and Technological Courses.) Revokes several 2nd series orders and Normative Order nr. 12/97, from March 6.

Normative Order nr. 15, D.R. nr. 67, Series I-B, March 20, 1999 – Approves the Regulation of Secondary School Exams. The regulation imposes: a) the preparation of the exam is responsibility of the Office of Educational Assessment (GAVE); b) the 12th grade exams of the general and technological courses, established by Decree n. 286/89, focus on a relevant core of objectives and contents which are the subject of the final exam for each 12th grade subject of the general and technological courses and of the 12th grade of the academic path; c) exams are graded between 0 and 200 points, with the final grade expressed on a scale of 0 to 20; d) juries formed by each school are responsible for the correction and grading of the exams and of the equivalence to attending exams for each subject.

Normative Order nr. 18, D.R. nr. 65, Series I-B, March 17, 2000 – Approves the Regulation of Secondary School Exams. Revokes Normative Order nr. 15/99, from March 20.

Decree nr. 6, D.R. nr. 15, Series I-A, January 18, 2001 – Approves the curricular reorganization of basic school.

Decree nr. 7, D.R. nr. 15, Series I-A, January 18, 2001 – Approves the curricular revision of secondary school in order to make school a more efficient context for student learning. To bring this proposal of curricular flexibility to life it is crucial that teachers stop seeing their action as curricular managers at the subject group level and start cooperating with all other teachers involved in the education of the same group of students (Barreira, 2002). It is necessary then that the programming of educational activities, which points to the contextualization of a global project, like national programs (Pacheco, 1996), be thought of in terms of school, team of teachers, and school community, instead of in terms of the action of each single teacher. It is in this context that Normative Order nr. 30/2001 is published, revoking all the previous orders of basic school assessment, and creating the prescriptive framework for the assessment of basic and secondary school.

Normative Order nr. 15, D.R. nr. 166, Series I-B, March 19, 2001 – Approves the Regulation of Secondary School Exams (2000-2001).

Normative Order nr. 30, D.R. nr. 166, Series I-B, March 19, 2001, p. 4438 – Sets the principles and procedures for the assessment of learning in basic school and, simultaneously revokes all the previous orders regarding basic school grading, creating the framework for grading in both basic and secondary schools. This legislation tried to tackle the great challenge of assessing the quality of learning and look for new solutions. This orientation was later on reverted by Normative Order nr. 1/2005 that, even though similar to the previous text, introduces changes that destroy the openness defended by Normative Order nr. 30/2001. Examples of this reversal are: the collection of data on the student named “individual student process” which is nothing but a bureaucratic and administrative process; on the other hand, it brought back the 9th grade national exams as an assurance of quality and accuracy. In basic school, as in secondary school, additive grading is now both internal and external. Once again the controversy regarding exams at the end of cycles as an assurance of quality and grading appears. The adoption of this model perfectly illustrates the immutability of the grading system, an eternal return to the past. A 9th grade student is expected to do five 90-minute written exams, which were later on reduced to two exams: Portuguese and Mathematics. At the same time Order 30/2001 identifies the need for schools to clearly show the grading procedures and the regulated self-assessment as an element of grading to be considered. Contrary to all expectations, the grading moments multiplied: four grading moments, two qualitative in nature (Christmas and Easter,) and two quantitative (at the end of the first semester and at the end of the year;) global exams at the end of the 11th and 12th grade and a final exam of Technological Aptitude at the end of the technological courses. Considering these facts, teachers continued to privilege the transmission of knowledge that would be the object of the different exams.

Decree nr. 209, D.R. nr. 240, Series I-A, October 17, 2002 – Amends article 13 and appendixes I, II, and III of Decree nr. 6/2001, from January 18, which sets the guiding principles of the organization and curricular management of basic school, as well as the learning and national curricular development process assessments.

Ordinance nr. 1551, D.R. nr. 298, Series I-B, December 26, 2002 – Makes adjustments to the study plans for the 1st, 2nd, and 3rd cycles of basic school.

Normative Order nr. 11, D.R. nr. 52, Series I-B, March 3, 2003 – Eliminates the global exams in secondary school as a mandatory grading instrument.

Normative Order nr. 15, D.R. nr. 81, Series I-B, April 5, 2003 – Approves the Regulation of Secondary School Exams for 2003.

Normative Order nr. 18 500, D.R. nr. 223, Series II, September 26, 2003 – Exam organization – scheduling.

Normative Order nr. 10, D.R. nr. 52, Series I-B, March 3, 2004 – Approves the Regulation of Secondary School. Revokes Normative Order nr. 15/2003, from April 5.

Decree nr. 74, D.R. nr. 73, Series I-A, March 26, 2004 – Sets the guiding principles of the organization and curricular management, as well as the learning assessment, for secondary school.

Ordinance nr. 550-A/B/C/D/E/2004, D.R. nr. 1119, Series I-B, 1st Supplement, May 21, 2004 – Approves the organizational, functional and grading regime for the secondary school technological courses. Approves the organizational, functional and grading regime for the secondary school artistic courses in the realm of visual arts and audio-visuals. Approves the regime for creation, organization, and management of the curriculum of secondary school professional courses as well as its learning assessment and certification. Approves the organizational, functional and grading regime for the secondary school scientific-humanistic courses. Creates several recurring secondary level education and approves the respective study plans. Approves the administrative and pedagogical organization, and the grading regimes applicable to the scientific-humanistic courses, the technological courses, and to the specialized artistic courses, in the realm of visual arts and audio-visuals, for the recurring secondary school.

Table 2.1 shows a summary of the educational system reforms and the curricular reorganizations implemented through legislation during these five decades, of which the organization of Basic and Secondary High School schooling, and the calculation of the weight the exam grade would have on University access can be highlighted.

Table 2.1. Types of teaching/training (continuing education course and technological courses)/calculation of the final grade of Basic and Secondary High School. Adapted from 50 Years of Educational Statistics – Volume I, 2009, INE & GEPE, Lisbon, p. 10]

<table>
<tr><th>School Year</th><th>Basic School/2nd Cycle</th><th>Secondary School/3rd Cycle</th><th>Calculation Formula for the Exam Grade/Final Grade/Application Grade to Higher Education</th></tr>
<tr><td>1950/72</td><td>Secondary High School – 2nd cycle (3 years)</td><td>Secondary High School – 3rd cycle (2 years)</td><td rowspan="4">1947–1968
Exam Grade – 2nd cycle
50% written exam grade
+
50% oral exam grade (students with a grade not lower than 16 are exempt from the oral exam; this grade went down to 14 in 55/56);
Exam Grade – 3rd cycle
50% written exam grade (average of the written exam with the practical assignments, if this grade is lower than 14 the student must do an oral exam)
+
50% oral exam grade
1968/1969
EG – 2nd and 3rd cycle
50% written exam grade (students with a grade not lower than 14 are exempt from the oral exam)
+
50% oral exam grade
Universities set their own access exams until 1974.</td></tr>
<tr><td>1972/73</td><td>Preparatory Basic (experimental 3rd grade);
Secondary High School – 2nd cycle (3 years)</td><td>Secondary High School – 3rd cycle (2 years)</td></tr>
<tr><td>1974/ 75</td><td>Preparatory Basic (experimental 3rd and 4th grades);
Secondary High School – General Course (3 years)</td><td>Secondary High School– 3rd cycle (2 years)</td></tr>
<tr><td>1975/76</td><td>Preparatory Basic (experimental 4th and 5th grades);
Comprehensive Secondary School (7th grade);
Secondary High School – General Course (2 years)</td><td>Secondary High School– 3rd cycle (2 years);
Student Civic Service</td></tr>
<tr><td>1976/77</td><td>Preparatory Basic (experimental 5th grade);
Comprehensive Secondary School (7th and 8th grades);
Secondary High School – General Course (1 year)</td><td>Secondary High School – 3rd cycle (2 years);
Student Civic Service</td><td>Final Grade of Secondary School:
$$\frac{\frac{MCG+(2\times MCC)+(2\times MDN)}{5}+NAP}{2}$$
MCG – Average Grade of the General Course of Secondary School
MCC – Average Grade of the Complementary Course of Secondary School
MDN – Average Grade of the nuclear subjects of the Complementary Course of Secondary School
NPA – Grade of the scientific and cultural level university access exam.</td></tr>
</table>

<table>
<tr><td>1977/78</td><td>Comprehensive Secondary School (7th, 8th, and 9th grades);
Secondary High School – General Course (night school)</td><td>Propaedeutic Year;
Secondary High School– Complementary Course</td><td rowspan="4">Final Grade of Secondary School:
$$\frac{\frac{MCC+MDN}{2}+NAP}{2}$$
MCC – Average Grade of the Complementary Course of Secondary School
MDN – Average Grade of the nuclear subjects of the Complementary Course of Secondary School
NPA – Grade of the Propaedeutic Year, calculated by dividing the sum of the grades in the nuclear subjects by 4.</td></tr>
<tr><td>1978/79</td><td>Comprehensive Secondary School (7th, 8th, and 9th grades);
Secondary High School – General Course (night school)</td><td>Complementary Secondary (10th grade);
Propaedeutic Year</td></tr>
<tr><td>1979/80</td><td>Comprehensive Secondary School (7th, 8th, and 9th grades);
Secondary High School – General Course (night school)</td><td>Complementary Secondary (10th and 11th grades);
Propaedeutic Year;
Secondary High School– Complementary Course</td></tr>
<tr><td>1980/81</td><td>Comprehensive Secondary School (7th, 8th, and 9th grades);
Secondary High School – General Course (night school)</td><td>Complementary Secondary (10th and 11th grades);
12th Grade;
Secondary High School – Complementary Course</td></tr>
<tr><td>1981/82</td><td>Comprehensive Secondary School (7th, 8th, and 9th grades);
Secondary High School – General Course (night school)</td><td>Complementary Secondary (10th and 11th grades);
12th Grade;
Secondary High School – Complementary Course (night school)</td><td rowspan="3">Final Grade of Secondary School:
$$\frac{G_{10/11}+G_{12}}{2}$$
$G_{10/11}$ – Average grades of the 10th and 11th grades or MCC;
G_{12} – is calculated by:
$$\frac{2G_1+G_2}{3}$$
Where G_1 and G_2 are the exam grades of the subjects for which the student obtained the highest grades in the 12th grade.</td></tr>
<tr><td>1983/92</td><td>Comprehensive Secondary School (7th, 8th, and 9th grades);
Secondary High School – General Course (night school)</td><td>Complementary Secondary (10th and 11th grades);
12th Grade – Academic Path;
12th Grade – Professional Path;
Secondary High School – Complementary Course (night school)</td></tr>
<tr><td>1992/93</td><td>Basic – 3rd Cycle (7th grade);
Comprehensive Secondary School (8th and 9th grades);
Secondary High School – General Course (night school)</td><td>General Courses (experimental);
Technological Courses (experimental);
Complementary Secondary (10th and 11th grades);
12th Grade – Academic Path
12th Grade – Professional Path;
Secondary High School – Complementary Course (night school)</td></tr>
</table>

<table>
<tr><td>1993/94</td><td>Basic – 3rd Cycle (7th and 8th grades);
Comprehensive Secondary School (9th grade);
Secondary High School – General Course (night school)</td><td>General Courses (experimental);
General Courses (10th grade);
Technological Courses (experimental);
Technological Courses (10th grade);
Complementary Secondary (11th grade);
12th Grade – Academic Path;
12th Grade – Professional Path;
Secondary High School– Complementary Course (night school)</td><td rowspan="3">Final Grade of Secondary School:
$$DFG = \frac{3IG + 2EG}{5}$$
Subject Final Grade:
IG – Average internal grade in the subject
EG – exam grade

1993/1994:
30% 10th and 11th grade grades + 10% 12th grade grades + 10% assessment test + 50% specific exams</td></tr>
<tr><td>1994/95</td><td>Basic – 3rd Cycle (7th, 8th, and 9th grades);
Night school General courses</td><td>General Courses (10th and 11th grades);
Technological Courses (10th and 11th grades);
12th Grade – Academic Path;
Night school Complementary courses</td></tr>
<tr><td>1995/96</td><td>Basic – 3rd Cycle (7th, 8th, and 9th grades);
Night school General courses</td><td>General Courses (10th, 11th, and 12th grades);
Technological Courses (10th, 11th, and 12th grades);
12th Grade – Academic Path;
Night school Complementary courses</td></tr>
<tr><td>1996/99</td><td>Basic – 3rd Cycle (7th, 8th, and 9th grades)</td><td>General Courses (10th, 11th, and 12th grades);
Technological Courses (10th, 11th, and 12th grades);
12th Grade – Academic Path;
Night school Complementary courses</td><td rowspan="4">1996/1997:
40% secondary school grade
+ 10% grade of the nuclear subject national exam
+ 50% grade on the specific exams

1997/1998 – 1998/1999:
50% secondary school grade
+ 50% grade on the specific exams

1999/2000 – 2004/2005:
50% secondary school grade
+
50% grade on the entrance exams</td></tr>
<tr><td>1999/00</td><td>Basic – 3rd Cycle (7th, 8th, and 9th grades)</td><td>General Courses (10th, 11th, and 12th grades);
Technological Courses (10th, 11th, and 12th grades);
12th Grade – Academic Path</td></tr>
<tr><td>2001/04</td><td>Basic – 3rd Cycle (7th, 8th, and 9th grades)</td><td>General Courses (10th, 11th, and 12th grades);
Technological Courses (10th, 11th, and 12th grades)</td></tr>
<tr><td>2004/05</td><td>Basic – 3rd Cycle (7th, 8th, and 9th grades)</td><td>Scientific and Humanities Courses (10th grade);
General Courses (11th and 12th grades);
Technological Courses (10th grade);
Technological Courses (11th and 12th grades)</td></tr>
</table>

This table does not include the exams from technical courses. The introduction of national exams for high schools in 1950 changed the calculation of the final grades for the 2nd and 3rd cycles. This change led to a great controversy in the 2nd cycle, mainly due to the absence of lab exams and the excuse from the oral exam only if a grade above 16 was achieved. The legislation was changed in 1955 to allow the excuse from the oral exam if a grade above 14 was achieved and to resize the extensive 2nd cycle Physical and Chemical Sciences curriculum. The lab exam of the 3rd cycle, abolished in 1968, allowed for some favourable bias in the grading of internal students, known to the examiners, when compared to the external students. The lab exam could be either on Chemistry or Physics, and the drawing prior to the exam led to diverging and inconclusive results.

The Veiga Simão Reform happens, on the one hand, due to the imposition to change the decontextualized and rigid curricula and, on the other hand, due to the discrimination in the access to high school education to lower, disadvantaged, classes. It was one of the most profound reforms in the Portuguese educational system and it led to an increase in literacy and skills of the Portuguese due to the democratization of access to education, “similarly to other European countries, where the duration of compulsory schooling was expanded in up to 230%” (Azevedo, 2000, p. 187). All the students who finished primary education had access to the “preparatory cycle of secondary school” and, later on, to secondary school or technical courses, which had become of similar length. The technical courses were aimed at training the student to enter the work force. Still, the Calculation Formula for the Exam Grade/Final Grade and the admission exam to University, responsibility of the different Universities, did not undergo any changes until 1976.

Due to the Revolution of April 25th, 1974[4], this reform was left unfinished. The 70s were extremely unstable and spent under a national and international crisis. The explosion in demand of education supported by policies that tried to solve the increasing unemployment amongst teenagers, due to the automation of production lines, had profound consequences in a whole generation. High school and technical courses are unified in 1975 and the Student Civic Service is created as a palliative for the lack of available seats in University level education. This civic service encompassed community service activities and concluded with a scientific and cultural level university access exam. The calculation of the final grade of secondary school was complex and included not only the exam grade but also the final grades of the 2nd and 3rd

[4] Date of the Carnation Revolution, which marked the end of the dictatorship.

cycles. Successfully concluding the Student Civic Service did not guarantee access to University, which led to question the investment around educational and training systems. The Propaedeutic Year replaced the Student Civic Service in 1977, supplementing the Secondary High School – Complementary Course. The education of the masses and the return of Portuguese from the old colonies led to a rupture in the capacity of schools. During the Propaedeutic Year students would study at home supported by the textbooks published by the MEIC (Ministry of Education and Scientific Research). It consisted of five classes, two were compulsory, Portuguese and a foreign language, and the remaining ones, considered core classes, depended on the University degree chosen. That year also saw the introduction of the numerus clausus, which determined each year the number of students allowed to enrol on the 1st year of each University degree and is still in place to this day. Secondary school saw the introduction of continuous assessment and final exams. The Propaedeutic Year was abolished in 1980, and replaced by the 12th grade, which initially included three classes (A. Teodoro, et al., 1984).

Table 2.1 allows for a better understanding of the changes that happened during this time, particularly the elimination of final exams for the 10th and 11th grades in 1983, keeping only the Assessment Exam (Leal, 1991). They were four types of courses in secondary school: General Courses (Teaching Path); Professional and Technological Courses (10th, 11th, and 12th grades); Professional Courses (10th grade, followed by an internship); High School and Technical Complementary Courses, as night school (10th and 11th grades), situation that will remain unchanged until 2000. There was a common structure to teaching, divided in several options that allowed for every student to “apply to University, continue their studies, or look for work” (Azevedo, 2000, p. 207). Compulsory schooling is extended to 9th grade in 1986 and there was a Curricular Reorganization supported by the Basic Law of the Educational System, implemented in 2001-2002 for the 1st and 2nd cycles, and in 2002-2003 for the 3rd cycle (Beato, 2003). Up to 2000 there were several changes to the calculation formula for the final grade due to the ever-changing number of subjects taught in 12th grade and to the changing focus on core subjects. However, although there were countless formulas used in the calculation of the Final Grade of High School/Secondary School, the one from 2000 to 2005 is very similar to the formula from 1947, with the exception of practical tests.

The interpretation of education legislation can be a fountain of inspiration for reflexions and help the perception of the dynamics of continuity and ruptures on an educational system.

However, to view the politics of assessment policy as either just another search by politicians for the magic bullet of education reform, or as their failure to understand the requirements of successful implementation, is to miss a much larger story with implications beyond education policy.

3 Literature Review

"Exams can be a means of understanding and promoting the renewal of the curricula." (Estrela & Nóvoa, 1983, p. 83)

The development of this chapter is based in two sections:

- a first section including the curricular contents and reforms during these five decades and their implications in the national exams;
- and a second section which aims to review and synthesize current findings as well as theoretical and methodological contributions about standard setting methods and evaluate them according to the guiding concept of items. Psychometric theory and cognitive analysis present the foundation for this analysis.

The evolution of our society imposes the constant updating of the Sciences curricula. The updates can be understood through the analysis of the evolution of the national exams. Keeping in mind the central part national exams have been performing in the design and implementation of learning and curricula, the analysis of the evolution of the Physics and Chemistry national exams shows the dynamic implications between the exams (different contents and learning) and the curricula, in the realm of the curricular reforms that happened in Portugal. This approach does not aim to show a compilation of the negative moments of the reforms throughout the decades, but to show that our school system nowadays has a higher demand level, both at the teaching level and the curricular level, highlighting a higher level of competence in abstract thinking, alongside with the increase of complementary curricular activities.

As it is never too much to highlight, it is not possible to reflect on the exams centring exclusively around the students and the technical concern of measuring their performance without keeping in mind the factors in play regarding learning, such as curriculum, cultural characteristics of the Greater Lisbon area, the organization of the School Community, and the part the Government plays.

The second section presents a brief summary of the research in this area, exploring the need to consider several analysis methods of item and test difficulty, followed by a discussion of the importance of cognitive analysis. The scientific study of the psychopedagogical problems regarding the evaluation of school knowledge in an exam and contest situation performed in the last 80 years has allowed the development of theories and methods to estimate the behaviour of students when faced with the items and the factors that contribute to the item difficulty.

3.1 Exams and curriculum change

The changes that occurred in the exam curricula and structure allowed for a better understanding of fluctuations in the degree of the exam's difficulty.

The evolution of our society imposes constant updating of the Science curricula. These updates can be understood through the analysis of the evolution of national exams since "the changes in the tests reflect the changes in education, which are a consequence of the evolution of society"(Patrick, 1996, p. 3).

Keeping in mind the pivotal role that exams perform in formulating and implementing learning and curricula, one proposes the analysis of the evolution of the national exams in Physics and Chemistry, showing the dynamic relationship between exams (different content and learning) and the curricula, within the context of the curricular reforms that happened in Portugal.

The national exams came out of the Pires de Lima Reform (1947) due to the strong controversy surrounding the district exams and their wide varying structure and content, making it impossible to have an unbiased national analysis of the results. During the 1940s Guimarães (1944) defended that "exams fatefully are what the teaching is, and teaching is what the curriculum structure is, programs, schedules, methods, because it is an organization where all the parts are connected and interdependent." (p. 28).

The need for a "profound and extensive reform of the High School Education towards the creation of a solid base, of clear continuity" (Tavares, 1945, p. 685) was undeniable, in order to address the arguments in favour of the standardization of the oral and written exams criteria. Another important point was that of security surrounding exam scripts. The suspicion of fraud was high in certain high schools, but tolerated as an "amusing prank." The problem reached its climax in 1944 with the public disclosure of a robbery of the Beja high school by at least a dozen students – the "grupo dos borgas" (the badinage group) – which led to the cancelation of the exams and the creation of new exams, in 48 hours, with a total cost of 400 contos[5] (Motta, 1944).

On the other hand, the criteria used in the exams before the reform allowed students who did not attend the lab classes to achieve a passing grade, for example, "an examinee of Physical and Natural Sciences (1943) who achieved the following grades: Practical exams – Chemistry, zero; Physics, fourteen; Written exams, a hundred and ten, a hundred and twenty-six" (Ataíde, 1944a, p. 2906). The student passed because the average grade was seven decimal points above the approval limit. This practice showed a true indifference for the practical work, considered by some as a "useless excrescence that only causes expense," (Ataíde, 1946, p. 223) which led to a true disavowal by the Science teachers.

Another important fact was the countless appeals presented at the MEN (Ministry of National Education) – DGEN (General Directorate of High School Education) regarding the exam results. Some pleas protested against the lack of teaching of subjects included in the exams as, for instance, in a plea from a student of Liceu Camões (M.E.N., 1943b), whose teacher Rómulo de Carvalho alleged teaching those subjects in extra classes, common fact during that time due to the size of the curriculum. Others were written by lawyers, with no knowledge of the subjects leading to baseless and erroneous pleas such as those found in the excerpts of Physical and Natural Sciences, 2nd cycle, shown (M.E.N., 1943a):

Physics question, answer and plea:

> 2) a) Question: Using the same balance scale of point 1, determine with simple weighting the mass of the same body, placing it first on the right weighting pan and then on the left one. Calculate the average of the values found in the two simple weightings. Which of the three values, 1st simple weighting (right), 2nd simple weighting (left), or average, appears to be the true value of the mass of the body? Justify your answer.

Answer: 1st – body on the right weighting pan m = 6.223; 2nd – body on the left weighting pan m = 6.24; average. The most accurate weighting is the average as it is rare that balance scales have two exactly matching arms and if it wasn't for this procedure one would never be able to determine an exact weight even in precision situations (scales).

Plea: There are two mistakes in the answer: 1st – taking the arithmetic average instead of the geometric average. This mistake is "compulsory." In fact, it is common knowledge that although Gauss's process will lead you to the geometric average of the values found in each of the weightings, one should take as the most likely to become the value of the arithmetic average, always higher than the geometric (in the case of real numbers).

The 2nd mistake is in the addition, unimportant then, 6.223 + 6.24 =12.863 instead of 12.463.

The remainder is entirely correct. It is because "one cannot expect both arms to be the same that one needs to resort to special weighting procedures." There is nothing to add. In conclusion: the answer is completely satisfactory. No one can find it strange that the examinee proceeded the same way, always in the current practice of weighting by transposition.

Chemistry question, answer and plea:

3) Question: Pour a solution of copper sulphate in a test tube. Add a few drops of caustic soda (sodium hydroxide solution.) Describe your observations. Add an excess of the reagent. Describe.

Answer: The green colour of the copper sulphate becomes a deep blue. The excess becomes celestial blue.

Plea: On the most renowned treatises one can read: "copper salts treated with an alkaline solution in excess will lead to a blue precipitate..." With drops (inappropriate here) as it was asked (to make things worse a low concentration solution was used) the student would not see anything useful. Even so, it is stated that the colour becomes a deep blue. The student indicates the initial green colour. There are no surprises here. We all know the mess that colours are for analysts, even for the most experienced ones.

As shown, there was a consensus in accepting the implementation of national exams. One of the arguments was the possibility of "submitting the students to similar tests with criteria uniformity in order to level the difficulty, and uncover excesses or deficiencies in the curriculum, thus highlighting differences amongst schools and regions" (Ataíde, 1944b, p. 138).

[5] In the current currency 2,000 euro.

This analysis begins with the exams between 1950 and 1973. The first national exams[6], between 1948 and 1950, are excluded, as they are a reflection of the inertia that accompanies all reforms. In the curriculum guidelines of the Reform it was literally stated that «it is intended that in this curriculum Chemistry is no longer seen by the students as a science bursting at the seams with formulas»[7] but for instance in the exams of the second cycle, up to 1951, you can see that the students were asked for formulas as in the old curricula. This fact led to a fiery debate between Rómulo de Carvalho and José Teixeira in the *Labor*[8] magazine, in which Teixeira (1951c) points to the need of "pondering calmly and investigating if there isn't a failure in results where those changes in the curricula are more extreme" (p. 118).

Amongst the several changes introduced with this reform in the second cycle, the elimination of practical exams in Physics and Chemistry stands out alongside the change on the number of teaching hours that led to the disappearance of 1.5 weekly hours of experimental practical work, usually done in laboratories like the one in figure 3.1.

Figure 3.1. Chemistry laboratory from Colégio Militar (Ataíde, 1944b, p. 2970).

Of the several confrontational criticisms against this change the ones by Teixeira (1951c) stand out by defending that "the students will now watch movies," and further ahead in the same

[6] Their conception became the responsibility of the Inspecção do Ensino Liceal (IEL, Inspection of High School Teaching), supported by a Ministry appointed group of teachers.

[7] These observations accompany the Decree nr. 37/112, of October 22, 1948.

[8] See Carvalho (1951a, 1951b), Teixeira (1951a, 1951b, 1951c) and Oliveira (1952).

article “Chemistry without experimentation is not modern nor archaic, it is not Chemistry. And teacher activity without student activity is not new nor renovating pedagogy: it is invalid” (p. 117).

The questions asked in the 2nd and 3rd cycle exams reflected, as a Principal described in the beginning of the 20th century, an “instruction of sciences that is too theoretical, aimed mainly at memorization, plagued with definitions, without the needed practice that eases and fixates tirelessly the driest and difficult subjects of high school Sciences and Humanities”(Carvalho, 1970, p. 149).

This can be illustrated by showing the Physics-Chemistry exams of the third cycle of this Reform, where the content on electromagnetism was requested: in the 1957[9] exam the student is asked to write an essay on one of the following themes “Hydro-electrical generators, Daniell and Léclanché batteries; dry cell batteries”; in the 1960[10] exam, “a brief report on your knowledge of: Electro-magnetic Induction”; in the 1963[11] exam, 1st call, “Enunciate the Faraday laws regarding electro-magnetic induction”; in the 1967[12] exam, 2nd call, “What are Tesla currents? How can they be produced?”

The lack of creativity is shown by the repetition (in the second cycle), word by word, of items such as the ones that appeared in the 1951[13] exam and again on the 1957[14] one.

> The three main sugars you studied are: glucose, sucrose, and lactose.
>
> a) Where from can one extract each of the mentioned sugars?
>
> b) Which of these sugars is the most important for nutrition? Why?
>
> c) Which of these sugars is susceptible of direct alcohol fermentation? What does that fermentation consist of?

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[9] Published in *Diário de Lisboa*, June 30, 1957, n. 12415, year 36, page 7. (online in http://www.fmsoares.pt/aeb_online/)

[10] Published in *Diário de Lisboa*, June 30, 1960, n. 13490, year 40, page 10.

[11] Published in *Diário de Lisboa*, June 28, 1963, n. 14560, year 43, page 14.

[12] Published in *Diário de Lisboa*, June 29, 1967, n. 15994, year 47, page 18.

[13] Published in the magazine *Labor, XVI* (122), 442-445.

[14] Published in *Diário de Lisboa*, July 1, 1957, n. 12416, year 37, page 7.

On the other hand, there were questions that were completely out of touch with technological evolution, clearly illustrated by the following question from the 1970[15] 2nd cycle exam:

> You studied two processes of gas lighting: by coal gas and by acetylene gas.
>
> a) How does one obtain coal gas and what are its most important components?
>
> b) Why are coal gas installations dangerous?
>
> c) How does one obtain acetylene? Write the chemical equation that shows its preparation.

This last example perfectly illustrates just how outdated the Physics and Chemistry curricula were. If in the 2nd cycle teaching had mainly an inductive character, the 3rd cycle employed a mathematical view, with a superior level of abstraction, making it hard for students to understand it (Silva, 2008a). Although the need for change was consensual, namely through an "offensive to the chemistry of chalk" (Teixeira, 1951c, p. 117), the curricula kept unchanged which led to countless criticisms like the one from Carmo (1960b): "we have asked ourselves countless times if the current Chemistry curriculum for the 2nd cycle serves the needs of current life and we are unfortunate to get a negative answer" (p. 300).

In the period between 1952 and 1973 there is a true technological revolution internationally. Amongst all the events in Science the highlights are the invention of television and of the transistor, the period after the creation of the atomic bomb, and the space age, its highest point being the moon landing (Blades, 1997). During these two decades, the social, scientific, and technological development required the training of professionals with knowledge and skills on the most recent developments in Science. Several innovative curricula, integrated in global projects, arose in order to satisfy this need, such as the Nuffield Advanced Physics (1971), in the U.K., with a strong experimental component supported by well-equipped labs.

According to Ogborn (2003), there were three main motivations behind the Science curricula renovations during the post-war:

1. Political and pedagogic: with the goal of refreshing and boosting the teaching of sciences within a solidly based teaching system, and improving scientific knowledge;

[15] Published in *Diário de Lisboa*, July 31, 1970, n. 17101, year 50, page 12, 13.

2. Economical: leading to economical gain through the improvement of the teaching of sciences;
3. Altruistic: like the Nuffield, in England, that pushed the educational system towards change.

In the early 1970s, the curriculum can be considered as a mirror of the social changes and of a relative political openness. During this time the protests against the curricula increased, boosted by several articles published in magazines on the subject of teaching. Almeida (1971) justified the poor performance of high school students and the need for a reform the following way:

> (…) keeping the same curriculum for more than 20 years[16] ... and considering we are talking about a subject like Physics and Chemistry, with an amazing reach and actuality, to which some of the most spectacular advances in science are connected, and of the technique that should stimulate teenage curiosity... thus, a reform in teaching, is a question of survival.(p. 256)

On the other hand, Carvalho (1970) criticized the evolution, better yet, the slow evolution of the teaching of Physics, since the Pombal Reform, and at the same time stated: “Will this be a first relief for alarm inclined spirits: today’s teaching crisis is the same crisis as ever, with the advantage that the good teachers of nowadays are better that the good ones from times past due to the excellent resources they have available”(p. 142).

As Alfredo Veiga-Neto (2008) defends, “the curriculum is an artefact of modernity,” as clearly demonstrated by the Veiga Simão Curricular Reform (1973) which, due to the 1974 Revolution, was not completed. At the time compulsory schooling was seven years long in high schools, and five years long in industrial and commercial schools. In this Reform there were certain general points worth noting such as: equal opportunity for all students in a democratic school, compulsory schooling is extended in order to increase the literacy level of the Portuguese population alongside the changes in the Physics and Chemistry curricula, with the introduction of contents such as the structure of matter and force fields.

All were expecting that the National Exams of 1974 reflected the curricular changes of this Reform, even on its early stages. And so it came to pass but its effects went unfelt as the national exams and the college aptitude exams were suspended due to student or faculty strikes.

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[16] The Physics and Chemistry curricula, proposed in 1948, suffered only slight changes in 1954 through the Decree nr. 39807, from September 7, 1954 (*Diário do Governo*, 1ª Série, nº198).

The development of written exams was one of the “serious problems of the years that followed the Revolution of April 25th” (Carvalho, 2010, p. 326). Until then, the written exams of any subject in secondary education were developed by the ME (Ministry of Education). With the chaos created by the Revolution of April 25th the situation worsened, not only because of suspicions of fraud but also because of the inclusion of political content in the exams. The exams were under the schools’ responsibility for a short period of time and the contents were ironically exposed in a survey presented by Carvalho (2010, p. 538), shown by the following questions:

> Public Secondary School
> 1974 — Complementary Course
> Time: 2 hours — 3rd Call
>
> Physics
>
> A PIDE agent free falls (Freedom!) out of the window of a 10m high 4th floor. Halfway through his travels, a foot comes out of a window on the 2nd floor applying a glorious armed force, from down-up, making him return to the starting point.
>
> a) Supposing that upon changing direction all the PIDEsc energy turned into heat, calculate the temperature of the body upon returning to the starting point.
> b) Do you think this temperature would be enough to cook a sunny-side-up egg on his head?
> c) And if it was not? How would you solve the problem? Give examples.

> Chemistry
>
> “Before April 25th, a Portuguese citizen went to get his salary, which was paid in 20-cent coins already heavily altered due to atmospheric agents. To make matters worse, the citizen also verified that six coins were withheld.
>
> Considering the described phenomena, state if we are dealing with an oxidation or a reduction. Justify.

The Curso Geral Unificado (Comprehensive Secondary School) is created in 1975, formed by the 7th, 8th, and 9th grades of the compulsory schooling, as a consequence of the fusion of high schools with commercial and industrial schools. It is also the inception of the short-lived Serviço Cívico Estudantil (Student Civic Service), a preparatory year for College admission, comprising of community service activities. It is replaced in 1977 by the propaedeutic year (consisting of five subjects). The propaedeutic year is eliminated in 1980 and replaced by the 12th grade, structured in two paths: the academic path, if one wished to continue their studies, and the professional path. Both the propaedeutic year and the 12th grade finished with national exams.

The Physics and Chemistry exams for the propaedeutic year were confined to the materials presented in the Textos Pré-Universitários (TPU, Pre-University Texts), produced under the supervision of the DGES (Direcção Geral do Ensino Superior). The experimental activities were given great importance as it can plainly be seen in the exam items, for instance, in the Physics-Chemistry exam, first set, 1979, exam C:

> I - Consider the nuclide ${}^{20}_{10}X$
>
> a) What is the name of the corresponding element?
>
> b) How many electrons and how many neutrons are found on that nuclide?

or in the Physics-Chemistry exam, first set, 1980, exam B

> a) Explain why the diamond, although it is a covalent material, has a very high fusion point.

The student preparation process was based on the mechanization of thought processes through the intensive training of questions (commonly known in jargon as “race horse training”) which, according to Popham (2001), is a good way of raising the test results. According to the first propaedeutic year Pedagogical Director “the massive failing verified in 1978 is mainly due to errors in the correction. Initially there were three teachers assigned per subject who, in the compulsory subjects, had to correct approximately 27 000 exams. Faced with this situation the exams were distributed by several secondary schools across the country where they could be corrected. The incompetence of the majority of the correctors led to the great amount of mistakes” (Telmo, 1978, p. 12). The results achieved in that year had a more selective character due to the introduction of *numerus clausus* (a pre-determined number of students that would be admitted for enrolment in the 1st year of each major in college), which is still enforced nowadays.

The Physics and Chemistry exams for the 12th grade, which had replaced the propaedeutic year exams, were not very challenging up until the 1989 reform.

They were still dominated by Newtonian Physics. The students would study entirely Newtonian concepts such as Kinematics, Kinetic Theory, or the Circular Motion, which, although they allow the explanation of many physical phenomena, limit our understanding of the natural world to a mathematized, deterministic, and linear Universe. Considering the Holocomb division (Osborne, 1990) of Physics in three great periods: the Newtonian (up to the 20th century); the Modern (up to the 1930s) and the Contemporary (where the discussion is focused on current questions such as cold nuclear fusion, the working of plasmas, or Chaos Theory), it is verified that the Newtonian domination intensified “the contrast and the absence of connection between the Physics that the audience’s imagination perceives and the Physics that is taught in the school”(Osborne, 1990, p. 190).

The exams did not offer any help in changing the kind of teaching offered, testing basic knowledge based on factual and abstract memory, with items as the ones presented here being very common:

Physics – 12th grade, 1st season, 2nd call, 1982 (code 280)

> 8. An ideal gas is in a container with a constant volume, at 10ºC and at 1 atmosphere of pressure.
>
> 8.1 If you double the average velocity by molecule, at what temperature will the gas be? Justify your answer.
>
> 8.2 Under these conditions, at what pressure will the gas be? Justify your answer.

Chemistry – 12th grade, 2nd season, 1981 (code 73)

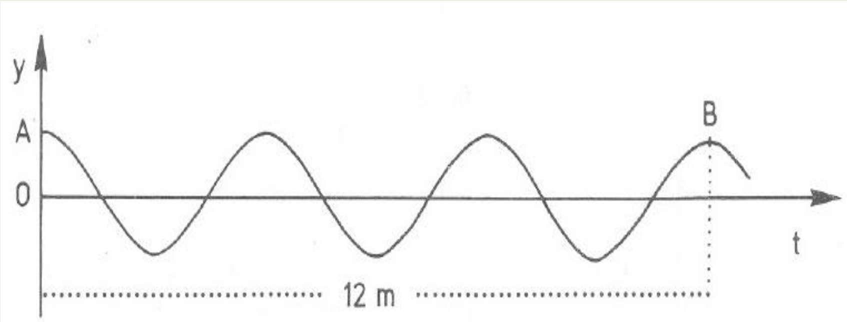
> 6. At a given temperature the value of pH of an aqueous solution at 0.15 M of hydrocyanic acid is five. Determine the value of the ionization constant of the hydrocyanic acid at that temperature.

It can be said that from the 1940s up to the 1980s the opinion regarding the influence of external exams in teaching-learning has remained basically unchanged and, as Orden & Soler (1982) mention: “it is a fact of common experience amongst educators that exams, what is demanded of students in exams, define the real objectives of learning and teaching [...]”, society demanded a global change in teaching-learning (p. 7). Facts like the exponential increase in enrolled students in all levels of teaching or the improvement of social-economic conditions of the great majority of the population were a major influence on this demand for change.

Another revealing aspect are the misconceptions and errors that appear through these decades of Physics exams, usually attached to graphical representations, responsible for discussions on the writing of the exams and their influence on the grades achieved.

Physics – 12th grade, 1st season, 1st call, 1982 (code 206)

4. Figure 1 shows a wave motion propagating in a given direction.



4.1 What is the wavelength of this wave motion?

4.2 If crest A takes 2 s reaching point B, what is the frequency of the wave motion?

In this exam the x-axis represents the time variable (expressed in seconds) and has simultaneously represented on it the wavelength of 12m between two wave crests.

The new Curricular Reform appeared only in 1989[17] following the publication of the Lei de Bases do Sistema Educativo (Educational System Law), in 1986[18]. As with all reforms, it was supported by a formal body of laws and regulations forming a complex project that set goals for the teaching-learning. In order to implement a reform, a great commitment from all members of the educational community is needed as the school, as an institution, does not act, "but only the individuals in or for the institutions" (Popper, 1992, p. 84).

If the Curriculum is considered a complex social project, its dynamic being dependent on several conditions that determine the "real curriculum" (Perrenoud, 1995), then the latter was often out of touch with what was defended on this reform.

On the 12th grade the contents on variable electromagnetic fields were no longer taught (it was not included in the General Curriculum Guidelines that determined the minimal compulsory content), mainly due to the deep exploration, and consequent increase in teaching time, on the teachers behalf, on the field of Mechanics.

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[17] From August 26, 1989 (*Diário do Governo*, 1ª Série, nº286).

[18] From October 14, 1986 (*Diário do Governo*, 1ª Série, nº46).

There was an increase in complexity on the exams following this Reform, mainly in Physics. Questions involving simultaneously projectile movement, magnetic fields, linear momentum and energy, appear, as seen in item 6 from 1996[19], considered by many inadequate to the teaching-learning of our schools.

6. Observe figure 3.2. A homogenous sphere E with a mass of 4.0×10^{-1} kg, behaving as particle, is electrified with a charge of 0.3 C and is resting in point A on an isolating horizontal surface.

Upon being activated by a constant force for 2.2×10^{-1} s, it travels a distance of 5.0×10^{-1} m, between points A and B, and maintains its horizontal movement until it begins a climb of the slant, that has a 53º angle with the horizontal.

The sphere, upon reaching the top of the slant at point C, at a height of 3.1×10^{-1} m, starts behaving as a projectile and, upon reaching the maximum height h, enters a magnetic field and maintains a uniform movement with a rectilinear and horizontal trajectory in that field.

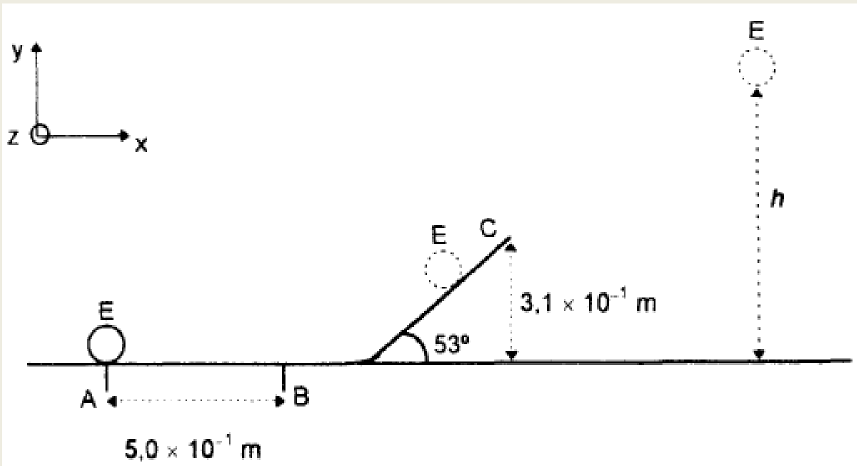

Figure 3.2.

Consider the horizontal surface as the level of zero potential energy and that the sphere keeps the same electrical charge throughout all of its movement.

Ignore the friction.

6.1. Calculate the work done by the force.

6.2. Calculate the variation of the movement quantity between points B and C.

[19] Test 215, National Exam, 1996, 12th grade (Academic Path), 2nd Phase.

> 6.3. Calculate the height, h, measured from the horizontal plane, where the sphere enters the magnetic field.
>
> 6.4. Characterize the magnetic field vector.

The most noticeable consequences of this type of question were the increase of failing grades and transforming Physics in an extremely discriminating subject (alongside Mathematics). With the introduction in 1997 of a group of multiple-choice questions (Tests with code 115) and a group regarding one of the twelve compulsory experimental assignments, the results improved. Still, the exam statistics developed by GAVE[20] after 1999 show us that, in general, the average grade of the Physics exams stayed under 10, unlike Chemistry that, despite some oscillations, stayed above 10. The Chemistry exams did not demand as many Mathematics concepts as the Physics ones, which explain the better student performance in items like the one presented in the 1996 Chemistry exam (1st phase, 1st call, test 242):

> 4. An aqueous solution of sulphuric acid at 1.00 mol dm^3 contains 4.9 g of acid and 55.1 g of water.
>
> 4.1. Calculate the density of the solution.
>
> 4.2. How would you dilute the previous solution to obtain 100 cm^3 of a sulphuric acid solution at 0.80 mol dm^3?

The lack of curricular coordination with Mathematics was one of the reasons for the negative results in Physics. Even before the Veiga Simão Reform, Carvalho (1970) noted that one of the most concerning issues was "the relationship between the teaching of Physics and Mathematics" (p. 153). This situation stayed the same for decades. Up to 2005, Physics teachers started the 10th grade by teaching mathematical concepts of vectorial calculus and, in the 12th grade, derivation rules needed for the mathematical treatment of physics problems.

The exams reflected this deep mismatch. The student was supplied with a cheat sheet with derivation rules for the Mathematics exam, but for the Physics (code 115) exam students needed to know those derivation rules, as they were not supplied with any cheat sheet, not even the one from the Mathematics exam. The Chemistry exams started, in 2003, to offer a small cheat sheet at the beginning of the exam. It is our belief that "an optimal evaluation method for all situations is yet to be found" (Cardinet, 1993, p. 49).

After 50 years, standard compliance failures during the exams still happen. According to the Júri Nacional de Exames (JNE, National Examinations Jury) events like written margins,

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[20] Gabinete de Avaliação Educacional (Cabinet of Educational Evaluation)

improper use of calculators, incorrect filling of exam headers, erasures in unauthorized places, wrong identification of the exam, led to the cancelation of 26 exams in 2005 (JNE, 2005).

It cannot be forgotten that the evolution of the contents of the exams was contextualized by the demographic and political evolution, and framed by the evaluation models that appeared during that period. Figure 3.3 presents a chronological summary of the deep reforms and the more or less permanent changes suffered by the educational system during the period studied, “highlighting the main political and demographic milestones in Portuguese society” (INE & GEPE, 2009, p. 10).

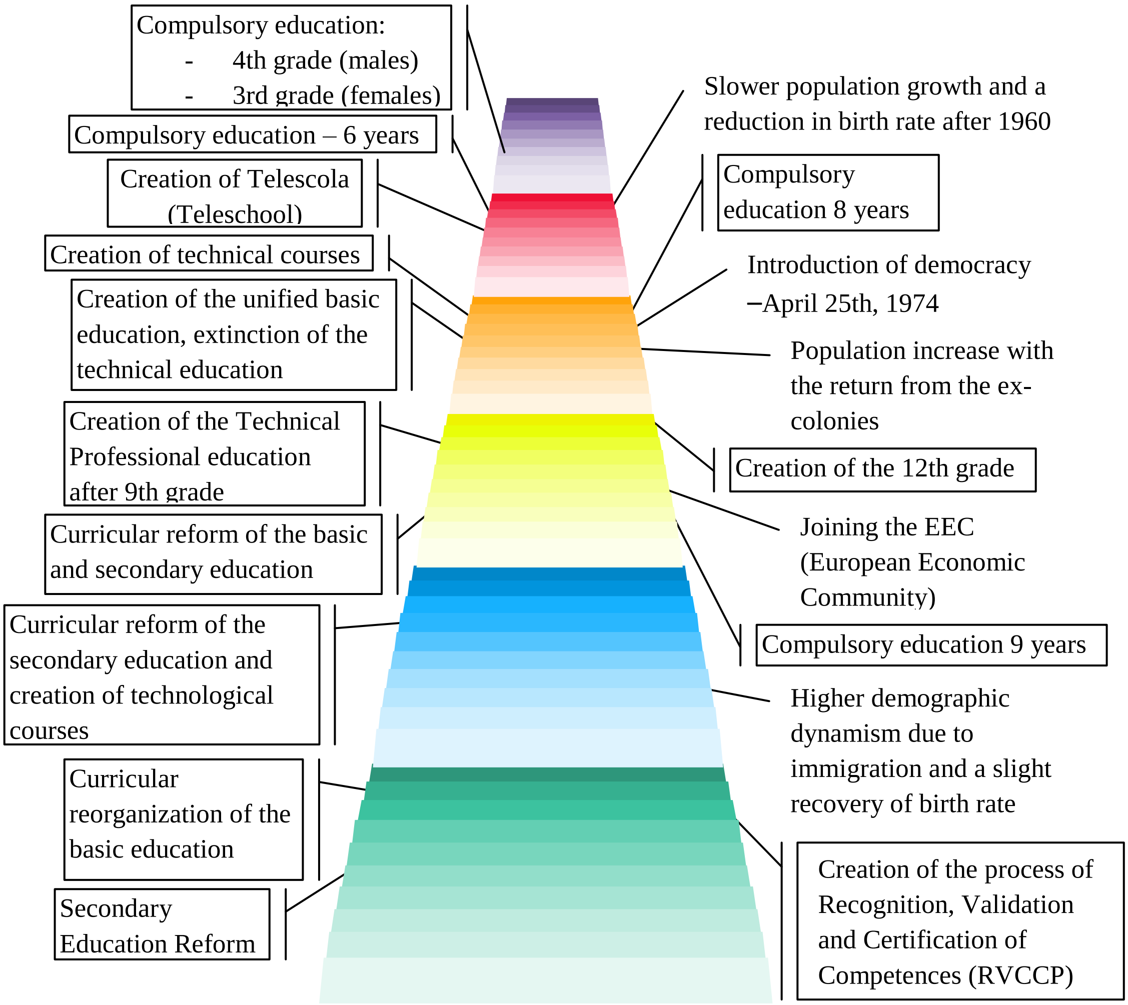

Figure 3.2. Social context and main educational policies (Adapted from 50 Years of Educational Statistics – Volume I, 2009, INE & GEPE, Lisbon, p. 12)

During these 50 years the evaluation evolved from an evaluation for measurement to a complex evaluation, where the idea of model appears associated to the idea of regulation and is based on a generalizing formalization from a studied situation. For that reason we share with Bonniol & Vial (2006) the opinion that “evaluation does not lead to theories” (p. 13), but to models. Still, only a critical attitude with amplitude framed by a tested model will allow the development of practical knowledge that can be useful for the creation of integrated items and exams.

A project to reflect on the curricula of the basic and secondary education was created as a consequence of the exam results. This project gave birth to guidelines for a Curricular Reorganization, which was implemented in the years for the 1st and 2nd cycles and in 2002-2003 for the 3rd cycle (ME/OEI, 2003).

There have been several theories, since 1950 that allow the comparison of the results of the evaluation of learning in different populations, in distinct places and times. Examples of those theories are: an Item Response Theory, IRT, the Classical Measurement Theory, and the Model of Evaluation of the Results of Learning (Modelo da Avaliação dos Resultados da Aprendizagem), associated to the idea of accountability, i.e., that the production and disclosure of information concerning the knowledge acquired by students in school are part of the Government duties regarding its accountability on the quality of the services it offers the population.

Exploring the role of exams in the curricula regarding its contents, competences developed, and structure is a controversial approach, as the results achieved depend on the contents taught, on the pedagogical objectives, on test correction methods, as well as on the behaviour of both examiners and examinees regarding learning.

3.2 Estimating item and test difficulty using psychometric methods

One of the goals of this research is to study the difficulty of the exams and items in the national Physics and Chemistry exams. This section begins with a short summary of the research in this area, the need to consider several analysis methods of the item and exam difficulty is explored, and the importance of a content and cognition analysis is defended.

The systematic scientific study of the psycho-pedagogic problems of the knowledge assessment in exams and applications began in the 1920s with Henri Piéron (Miranda, 1980). The researches done during the last 80 years allowed for the development of theories and methods to estimate the student behaviour related with items and factors that contribute to item difficulty. According to Hambleton and Jirka (2006, p. 401), the countless studies can be grouped in five categories: "a) studies on judging item difficulty; b) studies on other item characteristics; c) studies on item writing rules; d) research on other attributes affecting item characteristics; e) mixture of judgment and factor studies."

Farmer (1928) did one of the first investigations on item difficulty, and it presented two important points: the existence of a partial agreement between the judges estimates and the examinees' results, and the fact that the estimate done by the judges in a group is more reliable than their individual estimates.

Later on, Burt (1949) published a study on school and mental tests which focused on the difficulty factor of particular groups and the general population, following an order obtained by averaging the several rankings just as they stood. This study concluded that to estimate a general ability from grades in various subjects of the tests, first it should be set that their difficulty is approximately the same. New versions of the *Stanford Achievement Test,* a set of tests written under the supervision of Stanford University and taken by around 35,000 students in 33 U.S. states, were published. These tests focused on what were considered the most significant contents of the curricula and they "tried to ensure, as much as possible, the same level of difficulty" (Planchard, 1945, p. 12).

Lorge and Kruglov (1952) performed several studies to estimate the difficulty of a set of math items with a limited number of judges. Their task was to estimate the absolute difficulty (percentage of getting the correct item) and the relative difficulty (ranking of items.) Both the grading group that received empirical statistical data about the anchor items, and the grading group that did not get that information estimated the relative difficulty correctly. Still, the group with the additional information was a better judge of the absolute difficulty of the items. On a second phase the study included experienced math teachers and revealed a reduction of the judges' tendency to underestimate item difficulty when they had the additional information. Like in several studies, judges tend to underestimate item difficulty and that problem cannot be avoided. Impara and Plake (1998), in a study using several analysis methods, also concluded that the 26 judging teachers underestimated the performance of the total group of students as well as the performance of the minimally competent examinees. These conclusions highlighted the importance of an effective training with feedback for these judges. Another question raised was that of the possible dissimilarity in the capacity of judges with different competences to judge the items. Later on, Lorge and Diamond (1954) decided to study the judges skills regarding the estimation of item difficulty, and established that the inclusion of anchor items influences and helps the least qualified judges. These anchor items can be used to adjust statistically the results of the judges (Thorndike, 1982). Like Hambleton and Jirka emphasized,

> "(…) if a judge systematically underestimates the item difficulty by 10%, the results of their estimation for the anchor items can be the support to statistically adjust their difficulty estimates for the other items in 10% more. In this research on the Physics and Chemistry exams there were no anchor items supplied to the judges as this would distort the correct evaluation of the structure and content of each exam, item sequence, and answer time."
> (Hambleton & Jirka, 2006, p. 402)

One interesting work carried out by Chalifour and Powers (1989) identified several content characteristics that were good predictors of item difficulty, and, to a lesser extent, item discrimination (Boldt, 1998, p. 6). Among those content characteristics were the usefulness of illustrations in obtaining a correct answer, number of words, the stimulus material for the item and the number of rules or conditions in the test item. Besides the characteristics already mentioned, item difficulty is related to other factors. Some of the specific factors that contribute to increase item difficulty are: (1) negative statements; (2)the more items in a exam, the higher its difficulty; (3) vocabulary wise, the use of words with many syllables or uncommon words; (4) the length of sentences and paragraphs; (5) the level of abstraction, the higher it is, the higher the difficulty will be; (6) the placement of important information, placing it in the middle of the text could increase item difficulty; (7) the number and level of cognitive competences needed; (8) the originality of the item; (9) the placement of the item in the test since the ones placed last are usually harder and require good time management; and (10) the very similar distractors in multiple choice items.

Much of the work on specification of educational assessment follows Popham's prescriptions for domain, test, and item specifications (Popham, 1984). In Portugal, Valadares and Graça stressed, beyond these points, "the importance of "aligning" the grading with the methodologies and strategies used for curriculum development" (1998, p. 5). Unlike content standards, which have received intensive attention over the past decade, a small amount of research and development has been devoted to explaining learning progressions (Schmoker, 2006; Shepard, 2006). In a study Wiggins and McTighe (1998), suggested that devising an assessment that shows the learning goals is central to good teaching, not just a matter of measuring outcomes, and added the need of an "authentic pedagogy, higher-order thinking and deep-knowledge approaches" (Wiggins & McTighe, 2005, p. 306).

In Australia, consistent assessment systems with classroom and large-scale assessment associated to the same essential progress map are relatively well developed (Foster & Masters, 2004). Similarly, in the Netherlands, "learning-teaching trajectories" are being put into practice to provide much needed pedagogical insights to support the development of students' thinking over time (Heuvel-Panhuizen, 2001). On the other hand, the development of instructionally useful learning progressions in Portugal has been limited by the slow development of large-scale assessment systems over time.

Other interesting aspects regarding discrimination, difficulty, relevance of item content emerge in a study performed in the area of mathematics (Ryan, 1968). One of the findings pointed item relevance to the instructional content to be a major factor in determining overall item quality, but not item difficulty or discrimination. A number of teachers were able to provide statistically reliable estimates of item difficulties. However, the accuracy of the ratings varied and was not consistent for all the judges. Teachers did best when the test items were similar to those they might use on their own tests. There was a positive correlation between judgmental and empirical difficulty when the test content was perceived to be familiar to their students. Traditionally, tests often misdirected instruction, if they focused on what was easiest to measure instead of what was important to learn. This could be the reason why some teachers prepare their students almost exclusively to answer the typical questions that appear in final exams. This means that “the classical assessment system makes teachers prefer isolated and quantifiable competences instead of more complex competences (reasoning, communication), more difficult to take into consideration in an individual pencil and paper test” (Perrenoud, 1992, p. 3). This way, “teaching becomes restrictive and both the teacher teaching and the student learning act in accordance to the exam” (Sampaio, 1982, p. 6). Accordingly “assessment cannot promote learning if it is based on tasks or questions that divert attention from the real goals of instruction”(Shepard, 2006, p. 629).

Several studies published in recent years have produced explicit examination about the content knowledge and cognitive processes that test items require of examinees and of the degree to which these demands are consistent with the content knowledge and procedural requirements intended in content standards and corresponding item and test specifications (Linn, 2006). Studies that used statistical regression models to study contributing factors to examinee behaviour in face of items were discovered, such as the ones by Freedle and Kostin (1993, 1996), and Rupp, Garcia and Jamieson (2001).

There were other investigations about some detail factors related to item statistics. Two important studies about validity of judgmental estimates and as other issues effect item difficulty were carried out by Green (1983) and correlated item complexity with empirical and judgmental difficulty complexity. The conclusions showed that judges are capable of estimating relative difficulty, and can also make judgments about other factors. The notion that the estimation of the discrimination indexes of the items is a very complex task, which usually leads to unsatisfactory results, is common to all these studies. On the other hand, there are methodological limitations in the studies mentioned, and the importance of the training of the judges and the feedback regarding their work is highlighted. Content knowledge is one of the key factors of exam item difficulty and is connected with content standards.

The concept of content standards was introduced to “describe the set of outcomes, curricular objectives, or specific instructional goals that form the domain from which” (Cizek, 2006) an exam is built . In that context the designation of examinee’s performance should “be interpreted in terms of the content standards that the student, given his or her exam score, is expected to have attained”(Cizek, 2006, p. 14). A complete description of the term standard can be found on the book: Standards for Educational and Psychological Testing (AERA/APA/NCME, 1999).

Throughout this thesis, performance standards are high-lighted and are also referred to as a cut score or passing score. Therefore “setting performance standards" is focus on the “activity of deriving cut points along a score scale” (Cizek, 2006), without putting aside Kane’s definition (M. Kane, 1994), "It is useful to draw a distinction between the passing score, defined as a point on the score scale, and the performance standard, defined as the minimally adequate level of performance for some purpose. The performance standard is the conceptual version of the desired level of competence, and the passing score is the operational version" (p. 426).

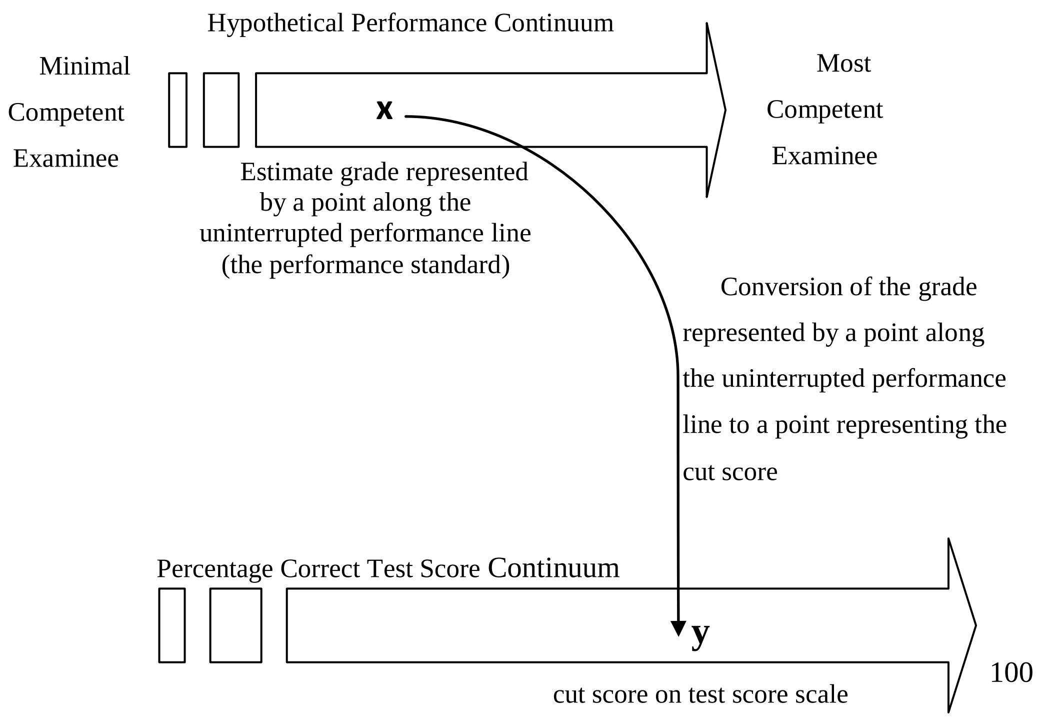

Figure 3.3. Relationship between performance standards and test scores [Source: based on (Cizek & Bunch, 2007, p. 16)]

Upper level in the figure shows a supposed uninterrupted performance line and the lower level shows the test score scale from 0 to 100 points. Teachers in standard setting estimate a grade represented by a point along the uninterrupted performance line that distinguishes suitable from unsuitable performance marked in the upper level as “x”. The assignment of cut scores may be a form in which the performance standard is, via systematic, judgmental means, converted into a cut score marked as "y" in the lower level of the figure 3.4.

The definition of standard setting proposed by Kane has two constraints. Since the term performance standard is often interpreted as a cut score or passing score one of the constraints is the difference between performance standard and passing score. The other one is the absence of the term inference, which is only implied in Kane’s definition, as the passing score defines two distinct groups of students: those who achieve a performance standard and those who do not. That can only be done with inferences about those individuals. The inference notion is therefore connected to an important psychometric concept called validity, considered “the most fundamental consideration in developing and evaluating tests”, and regarded as "the degree to which evidence and theory support the interpretations of test scores entailed by the proposed uses of tests" (AERA/APN/NCME, 1999, p. 9). Validity was considered "one of the major deities in the pantheon of the psychometrician" (Ebel, 1961, p. 640) but currently validity is connected with the inferences accuracy that are made about a student, supported by the performance of the student - such as on test scores of written exams. According to Kane (2006), determining validity comprises two aspects: first, the existence of bases that support the application of tests or inferences based on scores obtained in the tests, and secondly, a concern about the way inferences regarding scores and also the application of the tests are explored.

To sustain this view Cronbach and Meehl stated that , “one does not validate a test, but only a principle for making inferences" (1955, p. 300). Therefore, “Exams and exams scores cannot be said to be valid or not valid”(Cizek, 2006, p. 17).

In few words, “standard setting is the process of establishing one or more cut scores on a test” (Cizek & Bunch, 2007, p. 13). The role of cut scores is to create two or more contrasting groups of examinees according to the test scores obtained or related with predefined categories. The students’ scores in national exams, in conjunction with pressures for uniformity of testing, raise numerous issues of reliability and validity. According to Messick, “validity, reliability, comparability, and fairness are not just measurement issues, but social values that have meaning and force outside of measurement wherever evaluative judgments and decisions are made” (1994, p. 2).

There are three sources in the test content for defining the domain to be tested and the domain of inference from a test performance: “inferences to a curricular domain, inferences to a cognitive domain, and inferences to future performances” (Millman & Greene, 1989, p. 336).

Cizek suggested the following definition of standard setting “standard setting as is the proper following of a prescribed, rational system of rules or procedures resulting in the assignment of a number to differentiate between two or more states or degrees of performance" (1993, p. 100). Accordingly, throughout this thesis all the teacher’s work is called “standard setting”.

The process of standard setting can be divided into two aspects: a set of rules and procedures necessary to implement the process and the achievement of fair results. But fairness is, “to some degree, biased and interrelated with “persons' preferences, perspectives, biases, and values” (Cizek, 2006, p. 15).

Not all the contemporary theorists and practitioners shared the same point of view about standard setting. Jaeger emphasized that “a right answer - in standard setting - does not exist except, perhaps, in the minds of those providing judgment” (Jaeger, 1989, p. 492). As Cizek remarked (2001), “standard setting is perhaps the branch of psychometrics that blends more artistic, political, and cultural ingredients into the mix of its products than any other” (p. 5).

For many years there were two groups of standard-setting methods considered: test standard methods and examinee-centred methods (Cizek & Fitzgerald, 1996; Jaeger, 1989; M. Kane, 1998). But with the appearance of new standard-setting methods that classification became limited. To answer to that limitation, Hambleton, Jaeger, et al. (2000) proposed a new approach centred in judgments by panellists, divided in four categories:

1. Methods that involve review of test items and scoring rubrics;

2. Methods that involve review of candidates;

3. Methods that involve looking at candidate work;

4. And methods that involve panelist review of score profiles.

Some methods are better suited to certain types of tests or circumstances, but even in this case there are rules that indicate if a particular method must or must not be used with a particular type of test in a particular circumstance. Considering these four dimensions and the data collected, the following three methods were applied in this research: the *Angoff Method*, involving review of test items and scoring rubrics; the *Contrasting Groups Method*, involving a review of candidates; and the *Beuk Method*, considered a hybrid method. A review of these methods' literature can be found in Brandon (2002).

The most commonly used method for setting performance standards is the Angoff Method and all its variations (M. Kane, 1994; Meara, Hambleton, & Sireci, 2001; Plake, 1998). Mills and Melican (1988) justified the countless applications of this method with the fact that it is not "difficult to explain, and data collection and analysis are simpler than other methods in this category."

This method was first revealed in the "Scales, Norms, and Equivalent Scores" (Angoff, 1971), with two variations: one in the main text and another in footnote. The version in the main text is a simple version of the method (that Angoff attributed to Ledyard Tucker), "in which the standard-setting panellist provides an estimate of whether" (Koretz & Hamilton, 2006) a minimally competent examinee could give a correct answer or not. This version of the method is usually mentioned in the literature "as the yes/no method" (Impara & Plake, 1997) or item score string estimation method (Loomis & Bourque, 2001). Ironically, the method described in a footnote in the chapter is the one most commonly used and it is known as the Angoff method. In that method, panellists analyses multiple-choice items and estimate for minimally competent examinees, the probability of a correct answer in each item. The ratings obtained by each panellist are the result of sum of the items probabilities in the test. The performance standard is determined by an average of those ratings. The process can, of course, be repeated to set multiple performance standards.

According to some researchers Reckase and Bay (1999), the estimation of minimally competent performance tend to be lower for the lower performance standards and higher for the higher performance standards.

A great number of implementations of the method use the term "Extended Angoff" or "Modified Angoff" to reflect the addition of elements such as the provision of empirical item data to participants, encouragement of discussions among panellists, and the conduct of several rounds of ratings to enable panellists to revise their estimates (Mills, 1995).

The extended Angoff procedure described above was used in the Portuguese exams due to the existence of polytomously scored items. Following a study by Hambleton and Plake (1995), the method was applied to a multidimensional performance assessment. Instead of providing an estimate of the proportion of minimally competent examinees that would get a multiple-choice item correct, in this extended version panellists gave an estimate of the expected score a minimally competent examinee would obtain on a polytomously scored item.

In Hambleton and Plake (1995), panellists estimated the scores a borderline examinee would get on each of the three dimensions used to score, on a four-point scale, each performance task for the National Board of Professional Teaching Standards (NBPTS) certification exam. Then these estimates were summed to derive the expected score for the borderline examinee on each exercise. Similarly to the previous study, in Physics and Chemistry exams two dimensions were used, on a four-point scale for polytomous items, and a yes/no scale for multiple-choice items, in each exam.

Hambleton and Plake (1995) observed that although the Angoff method is a fully compensatory model, in which a high score on one exercise can balance a low score on another exercise, the standard that was ultimately set was not solidly in line with the panellists' preferences.

The Contrasting Groups Method is in the second category since it requires direct ratings of a sample of candidates. For educational assessment, students are placed into performance categories or on the borderlines of performance categories.

In this method, judges identify one group of examinees whose members are undoubtedly above a performance standard and another group whose members are below that performance standard. Then, the test score distributions of these two groups are compared to select the performance standard.

There are several approaches for determining the performance standards using this method. On the study of the Portuguese exams the method was applied with two performance categories, but it is easily extended to more than two categories by asking judges to sort known candidates into more than two performance categories, with the approach to data analysis being basically the same as for two categories.

Livingston and Zieky (1982) described dividing the score scale into intervals and calculating the percentage of examinees at each level who are judged to be qualified; this distribution can then be smoothed, and the point at which 50% of the candidates were judged qualified was used as the performance standard. An alternative approach is to select the test score that results in the fewest "false positive" mistakes (categorizing a below-standard candidate as meeting the standard) and "false negative" mistakes (categorizing an above-standard candidate as not meeting the standard) or some weighted combination of the two types of mistakes. Also, logistic regression can be used to find the test score that minimizes these two types of errors (Livingston & Zieky, 1989). This approach was also used by Sireci, Rizavi, Dillingham, and Rodriguez (1999).

An expected approach is to use ratters who are familiar with the examinees, which is not difficult in the context of an educational assessment, where teachers are familiar with the capabilities of their students. Even in that setting, however, there is the danger of the performance standards not being generalized beyond the examinee sample used for analysis (Hambleton, Jaeger, Plake, & Mills, 2000). An additional difficulty may arise in the contrasting groups approach when score distributions overlap and a clear separation to be used as the performance standard is not apparent.

The two standard-setting methods considered above could be termed “absolute” methods in that they attempt to establish a performance standard that is not influenced by normative information. On the other end, performance standards are called “relative” or “normative” standards (Nedelsky, 1954) if they reflect norm-referenced procedures, such as setting a performance standard to establish a certain percentage of passing examinees. As Cizek (1996) noted, in the 1970s absolute performance standards became more popular and in most cases replaced normative ones. However, several methods were developed in an attempt to affect a compromise between relative and absolute standards. One of these methods is the Beuk Method, described next, and intended for high-stake assessment with a single pass/fail performance standard, and can be used in several ways. It can be used as an unattached procedure to set performance standards or it can be used as a paired process to adjust scores obtained by other standard-setting methods. As such, Cizek observed that these methods can be seen as balancing two competing perspectives: a cognitive one linked to the judgmental task panellists are asked to undertake, and a political one tied to the realities resulting from setting a given performance standard.

In order to implement the Beuk (1984) method, panellists provide two judgments: (1) the percentage of correct answers that a minimally competent examinee should be able to get, based on the total possible test score, and (2) the expected pass rate for the examinee population. The mean and standard deviation of these judgments are calculated over the panellists. An adjusted value for per cent correct passing score and passing rate is obtained by graphing a line that takes the panellist values into account and determining its intersection with the curve linking pass rates (vertical axis) to possible passing scores (horizontal axis) using the distribution of candidate total test scores. Actually, as noted by Mills, the adjustments to per cent correct and passing rate will be smaller in the extent to which the panellists agree on their estimates of the two values. Graphical interpretations of this method may be found in Beuk (1984), Cizek (1996), and Mills (1995). In this compromise method panellists who do not have a great deal of experience with the performance of examinees may find it difficult to estimate a passing rate for them.

These three chosen methods “can be applied either before or after the test is administered” (Livingston & Zieky, 1982, p. 15). This brings one question: “What sort of things do we want to make inferences about, in order to understand students' learning? Questions like this one presented significant challenges for psychometricians for decades” (Mills & Melican, 1988, p. 266).

The information about how students learn to integrate structures and patterns into their perception, understanding, and action are important to build assessment tools.

Since a detailed analysis of cognitive psychology is not the main issue of this thesis, in this review of literature, only some points of cognitive analysis connected to assessment over the past years are shown. The cognitive analysis in assessment can be viewed through an information-processing perspective and a socio-cultural or situational perspective. The focus information-processing perspective focuses on the rules, principles, and methods for working with structured information, since

> “(…) there exist different integrations of knowledge, different degrees of procedural skill, and differences in rapid access to memory and in representations of the tasks one is to perform. The fundamental character, then, of achievement measurement is based upon the assessment of growing knowledge structures, and related cognitive processes and procedural skills that develop as a domain of proficiency is acquired. (Glaser, Lesgold, & Lajoie, 1987, p. 77)”

The socio-cultural or situational perspectives connect action and interaction in material and social situations, in particular

> “(…) the situative view of assessment emphasizes questions about the quality of students' participation in activities of inquiry and sense-making, and considers assessment practices as integral components of the general systems of activity in which they occur. (Greeno, Collins, & Resnick, 1997, p. 37)”

There are also two major domains in human cognition: knowledge and learning, revealing different *levels* of phenomena and cognitive processes. Assessment depends on all these aspects, and understanding about which “level a processing model or an assessment argument addresses, helps sort out issues of design and inference in practical applications” (Mislevy, 2006, p. 269). A way to understand human behaviour is to analyse the interaction among a “person and a situation”, and “mediated by the patterns through which the person interprets” the situation, “both experientially and reflectively”(Mislevy, 2008). There are two modes of cognitive activity: “the experiential mode and the reflective mode” (Norman, 1993, p. 15). The experiential mode allows seeing illuminated objects in space, including the recognition of people and objects, and estimates their distance, built in from the visual processing at the retina. The reflective mode depends on the concentration and the ability of the working memory. The effectiveness of reflective cognition is related with the nature, the size, and the portions activated from long-term memory. For instance, remembering nine arbitrary digits is a test, nevertheless to a Portuguese remembering the sixteen digits “1139164019101974” it is not difficult; it can be deconstructed in four portions, each a significant date in Portuguese history.

Discussing the performance of patterns in a sequence of situations leads toward the concept of perception that can be seen as conciliation between patterns detected in the surroundings, and memorized patterns. According to Mislevy “higher-level knowledge from long-term memory provides patterns for perception” (2006, p. 274). As Rumelhart stated

> “Perceptual experience is shaped by and in turn shapes the ever-accumulating patterns that constitute long-term memory. If perception is an active process (selecting, building, and tailoring representations from currently available schemas,) then learning is all the more dynamic: extending, modifying, and replacing elements to create new structures.” (1980)

Since “as with other types of experiential learning, aspects of spatial/visual patterns are more apt to modify long-term memory for subsequent perception” (Mislevy, 2006, p. 274).

Examples of knowledge representations in Physics and Chemistry include graphs, wiring diagrams, time schedules, mathematical notation and formulas.

A discussion about internal representation of knowledge is always connected with the knowledge of structures, and the importance of planning optimal instruction, because it is connected with students’ reasoning about finding experiences that are most likely to move thinking to the next level, to set the stage “for accommodation, in Piaget’s developmental terms”. Mislevy also remarked that “an optimal assessment would reveal key facets of a student’s understanding, to identify the student’s zone of proximal development, in Vygotsky’s socio-cultural terms” (2006, p. 277).

Many analyses have been carried out in physics in order to reveal students' conceptions and misconceptions. Misconception research provides backing for assessment warrants. The targeted inference is “What can this student be thinking of so that what he/she has just said makes sense to him/her?” (Thompson, 1982) The Force Concept lnventory (FCI) of Hestenes, Wells, and Swackhamer's (1992) contains multiple choice tasks about conceptions and misconceptions, built around key concepts in introductory mechanics. Another study carried out by Frederiksen and White (1988) based on “implicit assessment inside an intelligent tutoring system was designed to bring students through a sequence of increasingly sophisticated models for electricity”. Minstrell (2000) used open-ended in order to reveal students' thinking about gravitation effects. Minstrell “has identified common conceptions and misconceptions, facets in a number of domains by working from responses to open-ended tasks and from his experience in the classroom”. Like in Frederiksen and White's models ‘sequence Minstrell's facets “reflect levels of understanding”.

One of the recent studies in Physics about electricity and magnetism (Ding, et al., 2006) is centred in the assessment of the “reliability and discriminatory power of Brief Electricity and Magnetism Assessment (BEMA,) and uses statistical tests focusing both on item analysis (item difficulty index, item discrimination index, and item point biserial coefficient) and on the entire test (test reliability and Ferguson’s delta)”. Another research concerning energy assessment (Ding, 2007) encompassed two major components: the first component was the design of a valid and consistent tool for assessment and the second component concerned the evaluation of students’ understanding of the topics on energy. The interviews indicated that students were capable of performing qualitative analysis without using exact formulas and were able to correctly use the energy principle to tackle physics questions, if they chose to start from the fundamental principles. It was not possible to interview the Portuguese examinees that performed the chosen exams in the time period considered to assess common conceptions and misconceptions. Still, the same dimensions proposed by Ding (2007) were considered:

- Content dimension with three content levels (fact, concept and principal) and
- Cognitive dimension with three cognition levels (recall, comprehend and apply.)

According to Mislevy et al. (2007), assessment can be basically “structured around the knowledge, relationships, and uses of the domain representations” (recall, comprehend and apply.) In a higher level, assessment tasks include transforming “information from one representation to another, using representations to coordinate actions in situations and interactions” (synthesis and creation.)

Quantitative measurement, to whatever extent and whatever contexts it may be reflected in patterns of test scores, would be an emergent property of cognitive activities and resulting actions in particular contexts. A useful approximation may be found when assessing a certain collection of students with a certain collection of tasks under certain circumstances. But the model should be verified, not presumed, and the interpretation should be through model parameters, and not only observed scores (Wright & Linacre, 1989).

One way to understand setting standards is to combine cognitive research to design tasks and define evaluation rules, and the resulting scores to discuss students' capabilities at the coarse level of overall proficiency.

The literature review supported the adopted methodology, and its in depth description is present in the following point.

4 Methodology

> "Method is the attribute which distinguishes *research* activity from mere observation and speculation." (Shulman, 1988, p. 3)

The organization of this chapter is initially focused on the collection of data which led to a methodology centred firstly on the organization of the exam results and the creation of a database of national exams, and secondly on the selection of exam items involving Physics and Chemistry contents.

The close interdependency between learning dynamics and exam results through nearly half a century led us to a combination of several research methods based on documental techniques, mainly digital ones; surveys, content and cognition level analysis with the results obtained from distinct groups, in items with previously selected contents. A verification of the average difficulty and the item discrimination index was performed simultaneously.

The general methodological choice is closely related to the questions raised and the type of final product desired. The analysis allows investigating the existence of possible differences between examinees, and its interpretation can promote improvements in the teaching and learning process.

Keeping in mind the existing statistical data and the item format in exams, the application of the psychometric tools combined several adaptations:

1. In the period between 1950 and 1999,

a) Beuk Method (1972, 1982, 1983, 1984), as a holistic method;

b) Contrasting Groups Method, with the variation based on the average grades of the items proposed by Irwin, Bunckendahl, and Poggio (2007).

2. In the period between 2000 and 2005,

a) Beuk Method (2004, 2005), as a holistic method;

b) Extended Angoff Method (2004, 2005), with the True/False Angoff variation, suggested by Impara and Plake (1998, p. 69) for multiple choice items, and the Angoff Method extension, proposed by Hambleton and Plake (1995, p. 41) for the remaining items;

c) Contrasting Groups Method, with an adaptation of the linear regression model indicated by Cizek and Bunch (2007, p. 109).

The study also included an analysis of the content and cognition of exam items. The selection of the 12 items was based in two criteria: the two Physics and Chemistry contents belong to different curricular units and, on the other hand, those contents were touched on by the 2003, 2004, and 2005 1st phase, 1st exams call. The twelve selected multiple-choice items can be found in Appendix 2 along with the solutions. The statistical analysis of the examinees' results included a numerical presentation, showing item difficulty and to which point the items discriminate, and a graphical presentation which relates the grades achieved in the items with the two dimensions: content and cognition (Ding, 2007).

4.1 Sampling and Data Collection

The data collection led to a methodology centred firstly in the organization of exam results and creation of a national exam database, followed then by the selection of exam multiple-choice items regarding subjects of Physics and Chemistry.

The close relationship between learning dynamics and exam results of this last half-century have led us to formulate several investigative methods based on:

A. Documental techniques

Documental techniques, namely digital ones, allow for an intensive approach privileging the creation of a digital archive of national exams and the consultation of information using, for example, the Biblioteca do Conhecimento Online (B-on) [Online Library of Knowledge] and the Estatística Nacional do Ensino Secundário (ENES) [Secondary School National Statistics] and the Instituto Nacional de Estatística (INE) database. We also employed classical techniques such as the analysis of educational policy documents (legal diplomas, curricular reforms, and exam jury reports), the consultation of exam results in more than 20 schools, and the exploration of chronicles and articles produced by the media regarding exams. Naturally, the documental research is not limited to the national exams. It extends to studies regarding item content, item types, and cognitive items level.

The documental analysis embraces very diverse realities and perspectives and allows the researcher to broaden their theoretical scope, to comparatively localize their problem, find other results, and clarify ideas. According to Albarello et al. (1997), this analysis encompasses three great dimensions: a) scientific culture; b) theoretical framework; c) results and operational techniques; and uses essentially written documents – books, reports, and other sources.

Beyond the previously mentioned, other sources used in this research were:

- The consultation of the Arquivo Histórico do Ministério da Educação (AHME, Historical Archive of the Ministry of Education) at the Secretaria Geral do Ministério da Educação (SGME, General Secretariat of the Ministry of Education) was centred in: Direcção Geral do Ensino Liceal (DGEL, Directorate General of High School Education), series: 3 – Teacher Reports; 11 – Student Appeals; 12 – Exam tests; 13 – Miscellaneous; 16 – Exams; and 30 – Curricular Commission, including the scanning of documentation from 139 folders. This survey allowed for the collection of exams from before the Pires de Lima Reform, grade improvement appeals, and reports on teacher activity;

- Libraries, such as: Biblioteca Nacional (BN, the Portuguese National Library), Biblioteca da Escola Superior de Educação de Lisboa (BESEL, Library of the Lisbon School of Education), Biblioteca da Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa (BFCT-UNL, Library of the College of Sciences and Technology of the New University of Lisbon), Biblioteca da Faculdade de Ciências e da Faculdade de Psicologia e Ciências da Educação da Universidade de Lisboa (BFC-UL, Library of the College of Sciences, and FPCE-

UL, College of Psychology and Educational Sciences of the University of Lisbon), Centro de Recursos do Instituto de Inovação Educacional (CR-INE, Resource Centre of the Institute of Educational Innovation), and Fundação Mário Soares (FMS, Mário Soares Foundation). In addition to consulting books, this research encompassed the scanning of information regarding exams in magazines and national periodicals, namely: Arquivo Pedagógico (Pedagogical Archive), Boletim do Ensino Secundário (Secondary Schooling Bulletin), Boletim do Liceu Normal de Lisboa (Normal High School of Lisbon Bulletin), Boletim Oficial do Ministério da Educação (Official Ministry of Education Bulletin), Diário de Lisboa (Lisbon Diary, between June and September, 1950 to 1980), Gazeta da Física (Physics Gazette), Labor (Labour), Liceus de Portugal (High Schools of Portugal), O Jornal do Professor (The Teacher's Newspaper), O Professor (The Teacher), Palestra (Lecture), Revista da Educação (Education Magazine), Revista da Pedagogia (Pedagogy Magazine), Revista de Portugal (Portugal Magazine), and Revista Portuguesa de Pedagogia (Portuguese Magazine of Pedagogy). This systematic collection of information regarding exams in a period greater than 50 years allowed for a better understanding of the evolution of exams in Portugal.

To analyse test scores, two levels of comparisons were carried out: per total scores, and per item scores. The collection of test scores between 1950 and 2000 was done in four schools, between 2000 and 2003 included 24 schools, and between 2004 and 2005 all students were considered. The size of the sample constrained the methodology. Tables 3 to 8 show the total examinees' test scores collected. Due to the large volume of information collected there was the need to photograph the exam rosters and the final rosters, with the students' grades.

To Bell (1991) some "conditions and guarantees proffered for a school based research project are: all participants should have the opportunity to remain anonymous; all information should be treated with the strictest confidentiality; and participants will receive a copy of the final study". Even though the exam rosters are published at each school come exam time, and thus cannot be considered confidential, each school's management organizations were that those rosters would not be made public to avoid comparisons. Unlike the rosters, the results of the students' performance are confidential, and so they were transposed, item-by-item, to a grid for a later statistic treatment.

According to Bailey (1978), "where simple random sampling is used, the sample size needed to reflect the population value of a particular variable depends both on the size of the population and the amount of heterogeneity in the population". Cohen, Manion and Morrison (2001, p. 93) stated that "there is no clear-cut answer in support of the correct sample size, as that depends on the purpose of the study and the characteristics of the population under scrutiny", but it is undeniable that the larger the sample of examinees, the greater is its chance of being representative of the target population.

For Krejcie and Morgan (1970) "as the population increases the sample size increases at a diminishing rate and remains constant at slightly more than 380 cases (p. 610)" as shown in Table 4.1.

Table 4.1. Size of a random sample with the population size(N) and the sample size(S) [Source: Krejcie and Morgan (1970)]

N	S	N	S	N	S	N	S
50	44	200	132	500	217	2000	322
55	48	210	136	550	226	2200	327
60	52	220	140	600	234	2400	331
65	56	230	144	650	242	2600	335
70	59	240	148	700	248	2800	338
75	63	250	152	750	254	3000	341
80	66	260	155	800	260	3500	346
85	70	270	159	850	265	4000	351
90	73	280	162	900	269	4500	354
95	76	290	165	950	274	5000	357
100	80	300	169	1000	278	6000	361
110	86	320	175	1100	285	7000	364
120	92	340	181	1200	291	8000	367
130	97	360	186	1300	297	9000	368
140	103	380	191	1400	302	10000	370
150	108	400	196	1500	306	15000	375
160	113	420	201	1600	310	20000	377
170	118	440	205	1700	313	30000	379
180	123	460	210	1800	317		
190	127	480	214	1900	320		

The ideal setting would be to have samples of at least 380 examinees for each exam. That is not the case because:

1. The information is not available (NA) due to bad conservation, fire, or destruction;

2. The number of examinees that took exams in the two schools analysed up to 2000 varied considerably, due to the proliferation of new schools, population movement to the outskirts of Lisbon, school dropouts, and other factors.

Therefore quantitative analyses were performed on a large number of data regarded as nominal, from 2004 to 2005, and ordinal, before 2004. In an attempt to look at the examinees' test scores, comparisons were conducted using three standard setting methods: *Contrasting Groups*, *Beuk*, and *Angoff*. The purpose of the comparisons is to detect whether or not there were changes in the examinees' test and item scores over the years, mainly in four schools of the Great Lisbon Area.

Since comparability is difficult issue, this investigation

> "will involve comparing examinations in the same subject and at the same level, which means that the following very strict definition of comparability can be used: Two examinations are comparable if pupils who demonstrate the same level of achievement obtain the same grade. In practice, the difficulty is defining and identifying what is meant by the same level of achievement for a one syllabus." (Bell & Dexter, 2000)

There is diversity of approaches for this type of research, and three generic approaches were used to investigate this type of comparability:

- Using measures of previous results (internal final grade - IFG);
- Using measures of concurrent outcomes (Exam Grade - EG);
- Expert judgement of the qualifications (panel of qualified teachers).

To investigate the examinees' performance the three approaches were applied "but they have been separated since the advantages and disadvantages are different"(Bell & Dexter, 2000).

Since these methods involved measures of exam grades, the statistical procedure was similar to the study produced by Giraud et al. (2000), in which information from schools, in the form of teacher ratings and course information from schools, was triangulated with the results of several standard-setting methods (*Angoff*, *Contrasting Groups*, and *Borderline Group*). Although one of their conclusions was that the collection of the criterion information could take the place of conducting standard setting studies, they also acknowledged that it could be used to support the findings if such studies were conducted. Jaeger (1989) presented a summary of 12 studies in which 32 contrasts across methods were made, and suggested that, when possible, several methods should be used in a given study and their results considered in conjunction with other factors such as item content and cognition level.

Despite the evidence that different methods usually produce different performance standards, Zieky (2001) gave evidence that standard-setting comparisons across methods are useful, based on research findings in the area.

Performance levels are based on cut scores. The cut scores of standard setting are arguable (Falk, 2000, p. 86) because they depend on judgments made by teachers. A valid approach is based on standards which can be defined as "expectations for teaching and learning (Wilde, 1998, p. 79)." The setting of a cut score contains subjective elements, however according to Popham it is incorrect to "equate human judgment with arbitrariness in this negative sense (Valadares & Graça, 1998)," as Glass (1998) does, since that also involves a judgement.

B. Surveys

Since standard setting is a judgmental process, panellists (also occasionally called judges) are very important. The surveys (combined with groups of exams considered representative of the different areas studied) were submitted to a qualified panel of guest teachers, including authors of national exams, consultants, auditors, adjunct teachers, and teachers who grade the national exams. Knowledge about the content was the most important condition in panel selection since standard-setting methods often involve "complex judgments and insights into factors such as school curricula, the abilities of examinee groups, the characteristics of test items that determine their difficulty, and the demands likely to be placed on examinees later in their education" (Hambleton & Pitoniak, 2006, p. 451). The goal of these surveys was to apply the Beuk (10 panellists) and Extended Angoff (25 panellists) Methods to the exam results in previously selected schools. The analysis of the results allowed for the validation of some of the proposed hypotheses.

C. Analysis of content and cognition level of multiple-choice exams items from 2003 to 2005

The study of the differences of skills and processes in terms of understanding, application and grades in six exams (3 of Physics and 3 of Chemistry) was centred on 12 multiple-choice items involving similar contents.

From the analysis content and cognition level of those twelve items, two Physics subject topics and two Chemistry subject topics have been chosen:

Physics – Rotational Motion and Gravitation;

Chemistry – Intermolecular Bounds and Gas Laws, and Energy and Entropy in chemical reactions. Over the period between 2003 and 2005 there were no changes in content approach, since according to Murphy "comparability within a subject is likely to be more feasible, especially within the context of national secondary education" (Boyle & Christie, 1996, p. 90).

The twelve items were categorized independently by two physics and chemistry teachers both in content and cognition dimension. According to Ding (2007) in general, the three lower content levels (facts, concepts, principles) and the three lower cognition levels (recall, comprehend, apply) are suitable to categorize multiple-choice items. The descriptions used to categorize the content and the cognition levels are in section 4.3.

4.2 Standard Setting Methods

There are several standard-setting methods used to analyse the performance of examinees, linked with the expectations raised during the school year.

In order to reach the goals, this research starts with the analysis of performance standards, based on the expectations regarding the students' performance. Those expectations are processed in order to reveal competence levels obtained by distinct groups of examinees using three Methods: *Contrasting Groups*, *Beuk* and *Extended Angoff*.

A. Contrasting Groups Method

One of the goals of this study is to search for distinct examinee groups in examinations since 1949, covering a total of 68 193 examinees.

The global performance of examinees was explored using the Contrasting Groups Method, which allowed for the maximum distinction between two groups of students, and revealed deviations from the final internal grade, when compared to the Exam Grade.

This method, proposed by Berk (1976), considered to be examinee-centred (M. Kane, 1995), was chosen due to its simple implementation and easy understanding.

Initially the examinees are divided in two distinct groups, based on being graded or not by teachers. Then the graded examinees are divided in two distinct groups, based on an evaluation of their knowledge and competence. For instance, for internal students the selection was made by thousands of teachers which, by assigning an Internal Final Grade (IFG) to each student, allowed for the detection of a group of examinees whose elements are clearly below a given performance standard, and of another group whose elements are above that level. This is not a matter of labelling these groups comparatively to their Internal Final Grade, but rather of observing up to which point this classification matches the Exam Grade (EG).

Since the examinee sample should be large and descriptive of the target examinees, the universe of examinees was the largest possible in order to obtain more data on the differences between the IFG score and the Exam Grade of each student, and to lower the risk of the cut score greatly deviating from the IFG for each examinee.

Keeping this in mind, examinees who took these exams were assigned to the following groups:

Group A – students that applied for examination without being graded by teachers;

Group B – students that received effective instruction with Internal Final Grade scores;

Group B1 – students that received effective instruction with Internal Final Grade scores between 10 and 13, considered as barely competent;

Group B2 – internal students with Internal Final Grade scores above 13.

In defining Group B1 and Group B2 it is important to remember the following:

a) By considering the IFG to divide the internal students into two groups one assumes that all their grades are based on the same criteria. The teachers know the examinees personally and graded them throughout the school year, based on their knowledge and skills of the curricula contents and, regarding in particular the significant core of objectives and contents of the curriculum that determined the content syllabus of this examination. Even if we consider that any grading is susceptible to error, according to Cizek & Husband (Cizek & Husband, 1997, p. 18), "the error rate does not seem to have a substantial effect on the raw score accuracy of the examinee's universe";

b) The students with a IFG between 10 and 13 were considered as barely competent, meaning they have the basic requirements to take this examination and obtain a passing grade. This interval was not chosen randomly. Depending on the sample characteristics of each examination, the choice of this IFG interval is justified by the average of the results achieved by the examinees and by the Livingston and Zieky's (1982) proposal to organize two groups with similar percentage of internal examinees.

This method was applied, between 1949 and 1973, to the Physics-Chemistry exams of the 9th (2nd cycle) and 11th grade (3rd cycle) in two schools in the Lisbon area.

The three following tables show the distribution of examinees by grade, during the first three decades.

Table 4.2. Distribution of examinees from 1949 to 1959.

School year	Physics-Chemistry – 2nd cycle (number of examinees)		Physics-Chemistry – 3rd cycle (number of examinees)	
	Group A	Group B	Group A	Group B
1948/1949	NA	NA	128	92
1949/1950	138	103	NA	NA
1950/1951	275	92	NA	NA
1952/1953	279	79	NA	NA
1953/1954	343	103	50	46
1954/1955	NA	NA	30	62
1955/1956	305	98	31	78
1958/1959	NA	NA	85	49

Note: NA – Not available

Table 4.3. Distribution of examinees from 1960 to 1969.

School year	Physics-Chemistry – 2nd cycle (number of examinees)		Physics-Chemistry – 3rd cycle (number of examinees)	
	Group A	Group B	Group A	Group B
1959/1960	261	150	103	52
1960/1961	NA	NA	121	95
1963/1964	NA	NA	199	91
1964/1965	724	224	251	193
1965/1966	NA	NA	363	186
1966/1967	779	329	NA	NA
1968/1969	261	NA	131	128

Table 4.4. Distribution of examinees from 1970 to 1973.

School year	Physics-Chemistry – 2nd cycle (number of examinees)		Physics-Chemistry – 3rd cycle (number of examinees)	
	Group A	Group B	Group A	Group B
1969/1970	313	267	169	123
1970/1971	NA	NA	162	202
1971/1972	116	110	196	56
1972/1973	54	96	114	63

For the analysis between 1982 and 1999, another Secondary School in the Lisbon area was chosen as reference school. Both Physics and Chemistry exams consisted of a set of items, with topics from the 10th, 11th, and 12th grades.

In the 1980s the number of external examinees was very low due to several factors such as a high rate of school dropouts and a limited number of schools teaching 12th grade.

Table 4.5. Distribution of examinees from 1982 to 1989.

	Physics – 12th grade (number of examinees)			**Chemistry – 12th grade (number of examinees)**		
	Group A	Group B		Group A	Group B	
School year		B1	B2		B1	B2
1981/1982	28	125	223	18	82	243
1982/1983	49	54	93	40	110	117
1983/1984	48	43	86	24	54	75
1984/1985	33	131		49	110	
1985/1986	27	86		59	121	
1986/1987	31	85		38	51	
1987/1988	15	61		19	96	
1988/1989	20	53		24	73	

Table 4.6. Distribution of examinees from 1990 to 1999.

	Physics– 12th grade (number of examinees)		**Chemistry – 12th grade (number of examinees)**	
School year	Group A	Group B	Group A	Group B
1989/1990	32	92	44	37
1990/1991	27	87	33	34
1991/1992	34	78	18	26
1992/1993	28	49	30	54
1993/1994	31	63	20	33
1994/1995	15	51	24	41
1995/1996	24	33	22	32
1996/1997	21	31	40	12
1997/1998	16	27	34	88
1998/1999	33	21	40	35

For the analysis between 2000 and 2003 we considered 24 Secondary Schools in the Lisbon area. For the years 2004 and 2005 the data considers all the examinees that took these exams.

Table 4.7. Distribution of examinees from 2000 to 2005.

School year	Physics – 12th grade (number of examinees)			Chemistry – 12th grade (number of examinees)		
	Group A	Group B		Group A	Group B	
		B1	B2		B1	B2
1999/2000	33	43	30	23	53	42
2000/2001	42	61	40	31	38	29
2001/2002	44	74	37	71	60	42
2002/2003	104	155	120	122	104	119
2003/2004	1822	5216	2794	3789	9018	7902
2004/2005	1630	5325	2640	3812	10221	8103

In the implementation of the Contrasting Groups Method, for the 2004 and 2005 exams, the exam grade (0 to 20.0 points) was divided into 21 intervals associated to a reference classification grade between 0 and 20. The criterion used for the grouping of exam grades in an interval is identical to the one used on the rounding to the unit when converting a grade from a 200 points scale to a 20 points scale (table 4.8).

Table 4.8. Distribution table of the exam grades (EG) in 20 reference grades.

Reference Grade	EG Interval
0	[0,4]
1	[5,14]
2	[15,24]
3	[25,34]
4	[35,44]
5	[45,54]
6	[55,64]
7	[65,74]
8	[75,84]
9	[85,94]
10	[95,104]
11	[105,114]
12	[115,124]
13	[125,134]
14	[135,144]
15	[145,154]
16	[155,164]
17	[165,174]
18	[175,184]
19	[185,194]
20	[195,200]

The exam grades (0 to 20.0 points) obtained by examinees before 2004 (smaller samples) were compressed into ten intervals related to a reference grade (Table 4.9).

Table 4.9. Distribution table of the exam grades (EG) in 10 reference grades.

Reference Grade	EG Interval
2	[0,2.4]
4	[2.5,4.4]
6	[4.5,6.4]
8	[6.5,8.4]
10	[8.5,10.4]
12	[10.5,12.4]
14	[12.5,14.4]
16	[14.5,16.4]
18	[16.5,18.4]
20	[18.5,20.0]

The reference grade and the frequencies allow for graphical representations, such as the smoothed distributions of Group A and B and Group B1 and B2 shown in results.

In the statistical analysis there are a few important points to consider regarding student performance:

1. The cut score precision depends on student achievement, and that performance should be in accordance with his regular performance (Teodoro, Valadares, Matos, & Caldeira, 1998). When considering all the examinees as internal we admit that this, on average, is true;

2. Contrary to popular believe, the exam classification does not appear as an absolute fact but as a value dependent not only on the examinees performance level, but also on the reference system chosen (measurement scale, correction criteria, etc.) The group of technical factors of undeniable importance will be discussed in item analysis.

The graphs cut score is an approximate value. There are three different procedures within this method, known as Modified Contrasting Groups Method 1, Modified Contrasting Groups Method 2 and Linear Regression, which can be used to more accurately find the grade that best differentiates between groups.

Modified Contrasting Groups Method 1 (MCGM1)

For the implementation of this procedure, proposed by Irwin, Bunckendahl and Poggio (2009), one first needs to determine the medians of the exam classifications obtained by students of groups A and B and then consider the middle point of those two medians. This method puts the performance of both groups of students at the same level.

To avoid loss of information and increase the accuracy of the measurement, the values of the medians in both distributions were calculated from the individual exam classifications and not from the intervals considered in the graphical representation.

A simpler version of this variation (Cizek & Bunch, 2007, p. 107) consists of calculating the values of the mean exam classification of both groups to obtain the midpoint between the two means.

Modified Contrasting Groups Method 2 (MCGM2)

In this second version of the method (Fernandes, 2009) the grades of the examinees are studied together, with no group distinction. To determine the raw score that maximizes the difference between both groups one simply needs to calculate the median of that population.

Any of these two procedures satisfy the method when used with small samples. However, if the samples contain thousands of elements, according to Cizek & Bunch (2007) it may be preferable to use a logistic regression.

Linear Regression

The model of logistic regression was used in order to analyse the behaviour of the internal students in the 2004 and 2005 exams since it requires few assumptions in theory. In this method the response variable is dichotomous (showing the relationship of belonging or not to a group,) with the goal of estimating the raw score that distinguishes both groups.

Logistic regression, by default, estimates the highest of the two distributions (designated by 1 – belonging to Group B,) using the lowest (designated by 0 – belonging to Group A) as the reference distribution.

Statistics software SPSS version 10 and Excel were used for the classical analysis. All the grades were entered in a single step, causing no variation between step, block and model, when measuring significance levels with the χ^2 method.

The results of the Likelihood function to test if an independent variable is or is not related to the dependent variable are shown in the summary of the model.

The general logistic regression equation used to obtain a Contrasting Groups cut score with only one independent variable is

$$y = a + b\,(x)$$

where *a* is a constant, *b* is the slope of the regression function, *x* is an examinee’s observed score and *y* is the predicted value on the outcome variable for the examinee.

In typical regression contexts, one is interested in obtaining the predicted score, *y*, related with a given *x* value. In this case, we intend to discover the value of *x*, associated with a result located between both distributions (Group A and Group B.) The two distributions have been coded as 0 (Group A) and 1 (Group B) and y = 0.50 since this option sets false positive and false negative classifications errors as equally serious.

B. Beuk Method

The Beuk Method was chosen to evaluate the comparability of the exams used in this study. Since all methods are likely to have their limits, the choice of a holistic method for standards setting can be understood by the available statistical data. There are no item results for exams before 2000 and without them item-based methods such as Angoff, Nedelsky, IRT or Bookmark methods could not be used.

Considering the current programs, the legislation, and the teaching-learning methods, this study focused on a total of fifteen exams distributed into three groups:

Group I – Physics-Chemistry exams of 1956, 1960, 1965, 1969 and 1972;
Group II – Physics and Chemistry exams of 1982, 1983 and 1984;
Group III – Physics and Chemistry exams of 2004 and 2005.

The main reasons for the choice of these three groups were:

- Group I – these five Physics-Chemistry exams were chosen according to the following criterion: one of the first decade, three of the second decade, and one of the last exams of the 1949 educational reform which was closely related with the “first wave of science education reforms after World War II” (Blades, 1997, p. 12) and were taken by students at the end of the 11th grade (see number of examinees sample in Fig. 4.1.);

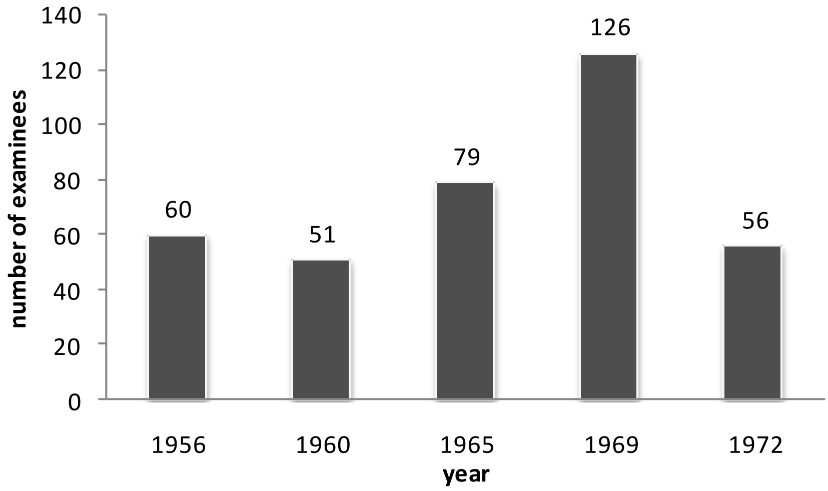

*Figure 4.1.*Distribuition of examinees from Group I

➢ Group II – these six Physics and Chemistry exams were the first of the curriculum reform that split in two exams Physics and Chemistry, and were taken by students at the end of the new 12th grade (see number of examinees sample in Fig. 4.2.);

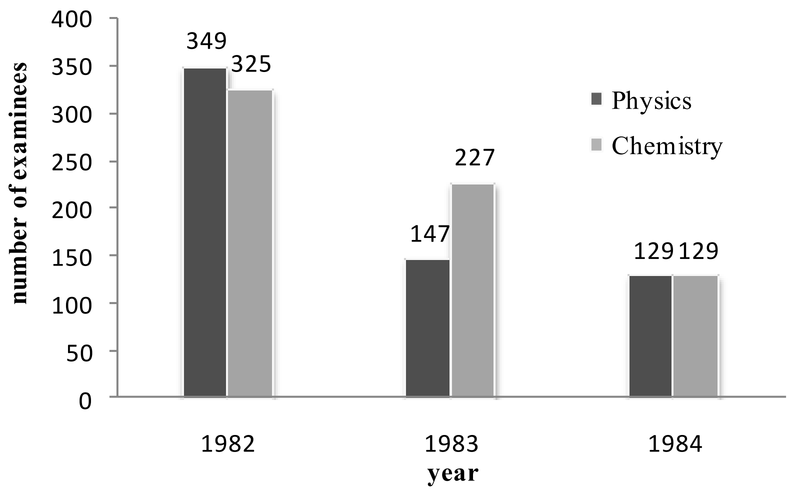

*Figure 4.2.*Distribuition of examinees from Group II.

➢ Group III – these four Physics and Chemistry exams were the last exams of the 1996 educational reform, which introduced a new exam structure with, for instance, multiple choice items, and were presented to students at the end of the 12th grade (see number of examinees sample in Fig. 4.3.).

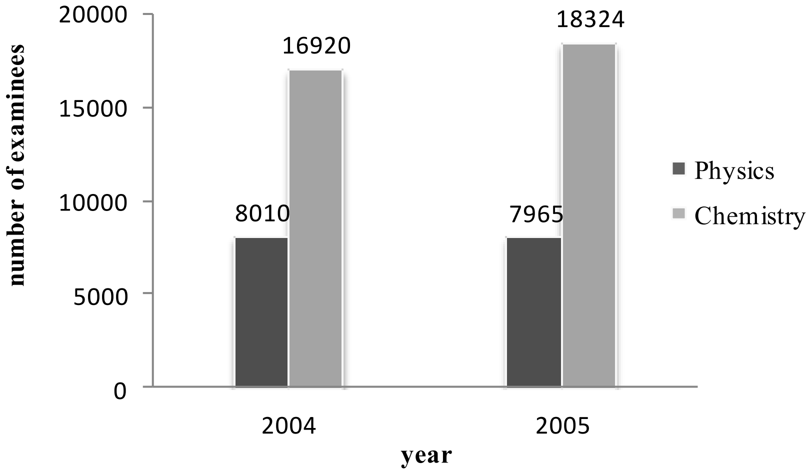

*Figure 4.3.*Distribuition of examinees from Group III.

For the analysis until year 2000 four schools from the Lisbon area were chosen as reference schools. They are well known schools in Portugal with a history of good and strict results on teaching-learning for more than one hundred years, fifty years and forty years, respectively.

For 2004 and 2005, all the national results from these exams were considered.

To set performance standards (Beuk, 1984) for each exam, two questions A and B (Cizek & Bunch, 2007, p. 213) were asked of a selection of ten teachers:

> QA – "What should be the minimum level of knowledge required to pass this examination?" (Since the applicants were internal students from public and private schools, the minimum level to this selection was 100 points on a 200 points scale);
>
> QB – "What passing rate should be expected on this examination?" (Considering the passing threshold of 95 points on a 200 points scale).

The selected teachers raised some ethical issues in this research. In question A the conditions considerably limited the answer. The main problem in question B was to analyse the traditional and very formal contents of Groups I and II without taking into consideration the demands of knowledge and skills in the technological domain in Group III, such as, for example, the use of graphic calculators. According to Bárcena, (2002, p. 2) "the environment around us affects our observation, the way we look at past exams", and for this reason it was not easy to answer these two questions.

In order to apply Beuk's method, the judgments of these ten teachers were compared to 52,525 student's results. These students were chosen according to the following criteria:

1. External or self-proposed students were not considered;
2. Only students with an internal classification of 50% were selected;
3. The exam classification concerns only the written exams and not the laboratory exam or oral exam.

The judgments of the teachers on the 2004, 2005 exams were consensual. Reliability in standardized tests is usually higher. Although after a standardizing meeting all the teachers had strict recommendations of what the answers to the questions should be, it is possible that the same teachers would make different judgments because there are only few multiple choice items.

C. Extended Angoff Method

The goal of this comparison is to analyse the item performance level of examinees in Physics and Chemistry exams in 2003, 2004, and 2005. The analysis seeks an answer to the following question:

- Can we detect differences in the global performance of these internal students?

The items are the focus of the Extended Angoff Method. In the simplest implementation of this method, a panel of teachers estimated the probability of a certain group of students answering correctly to each item of the exams. The mean of the teachers' estimates allowed for:

a) An estimate of the cut score to distinguish the performance of two groups of students (below designated by groups B1 and B2, respectively, students with an IFG between 10 and 12 and students with 13 or more, on a 20 scale);

b) A comparison of the average estimated score for each item with the average scores achieved by a group of examinees.

The selected students were submitted to those exams at the end of the school year, after obtaining the IFG score assigned by their own teachers. Only those with the minimum score of 10/20 were considered to have the minimum requisites to take the exam. In this analysis, the students were divided into two groups B1 and B2 according to their Internal Final Grade (considering that the teachers grading criteria for calculating the IFG were similar) as shown in figure 4.4.

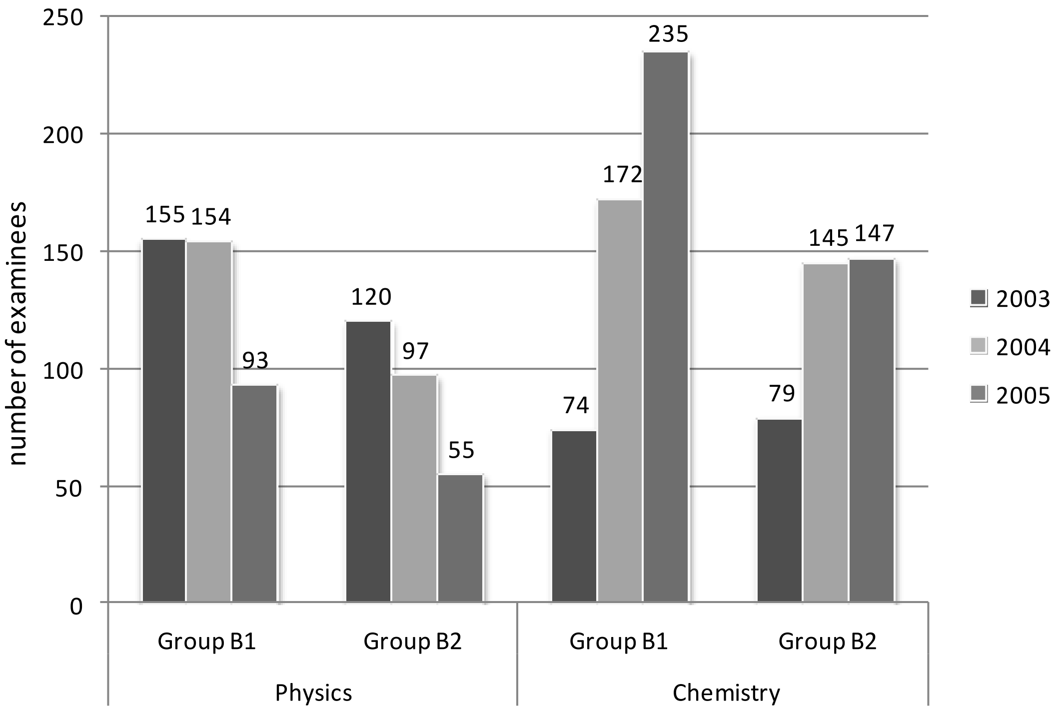

*Figure 4.4.*Distribution of Physics and Chemistry examinees from 2003 to 2005.

The two following reasons influenced the choice of this IFG interval: according to the data supplied by the final report of the Examinations National Jury the examinees had an average which placed the students of our sample near the observed average; and Livingston's and Zieky's proposal (1982, p. 26) that recommends "two groups with similar percentage of internal examinees".

Considering the item format, the comparison combined two adaptations: the Extended Angoff Method – the True/False Angoff Variation suggested by Impara and Plake (1998, p. 69) for multiple choice items, and the Angoff Method Extension proposed by Hambleton and Plake (1995, p. 41) for the remaining items. The comparison of methods with different procedures is only possible by keeping the same participants and by applying identical mathematical procedures.

The teacher panel was carefully selected and it included exam authors, consultants, and very experienced teachers, as Popham suggested (2001, p. 298). It should also be noted that the number of teachers exceeds the minimum of twelve grading teachers considered necessary to achieve an acceptable reliability level. The selection criterion was based on the need to perform extremely complex cognitive tasks, namely: conceptualizing a performance level; identifying the student in that level; “put yourself in the student’s shoes, in exam circumstances; and estimate that student’s performance in items with different formats” (Giraud, Impara, & Plake, 2005, p. 310). The knowledge and experience of the teachers were deemed sufficient to get a credible estimate using the Extended Angoff Method.

In both methods the mathematical approach involved:

a) The calculation of the average grades of the items and of the examinees, with the goal of estimating the cut score that distinguishes both groups and the behaviour of the examinees when faced with the items;

b) The linear regression model, applied to the examinees (Contrasting Groups Method) and to the items (Extended Angoff Method).

It is a new approach since it doesn’t focus only on the item answer, as suggested by Brandon (2002, p. 168), but also on the Exam Grade.

The Angoff Method is frequently used to evaluate the “quality of teaching at a high school level” (Mills & Melican, 1988, p. 264) since it incorporates complex evaluations involving items with mixed formats. On the first variation of the method proposed by Angoff in 1971, the Group C of 25 grading teachers estimated the right answer for each item, for the examinees in Group A.

In order to reduce the difficulty of the estimate, the True-False variation of the Angoff Method was applied to the multiple-choice items. Those items had a dichotomous score (0 or 0.5 points out of 20) and the grading teachers, on their estimate, selected 1, for a right answer, and 0, for a wrong answer. On the remaining nine polytomous constructed-responses the variation of the Angoff Method was applied. The procedure consisted of estimating on a scale from 1 to 4 the probable grade of the examinees from Group A, in order to allow its treatment and later comparison to the results of the examinees.

The mathematical procedure used for the values estimated by the grading teachers was identical to the one used in the Contrasting Groups Method (O'Connell, 2006), both when calculating the averages, and on linear regression, as well as on the software used.

Before showing the results there are important details regarding student performance, and the selection and treatment of the exam grades that should be highlighted:

a) It was considered that the examinees’ performance was similar to their usual performance, because if this hadn’t been considered “the degree of accuracy of the cut score would be lower" (Zieky, Perie, & Livingston, 2008, p. 130). In addition the comparison between the examinees in the groups only makes sense if the examinees "are very similar in the types of knowledge and skills measured by the test" (Samuel A. Livingston, 2006, p. 436);

b) To avoid loss of information and increase the accuracy of the measurement, the individual Exam Grades values given by the teachers at the end of the school year were used in the calculation of the averages of both groups and on the linear regression regarding Groups A and B, instead of the intervals considered in the graphic representation.

Regarding the items, each grading teacher performed a "blind" grading. This means they estimated the scores of the items for a "minimally competent" or a "just barely passing" student (Angoff, 1971, p. 515) not knowing the specific performance level for each one of the examinees in Group A.

4.3 Content and cognition level of exams items

To better understand the results at the content and cognition levels these analyses assign the scores from student groups according of the cognition level of the item and the selected program contents. Simultaneously, a research of the average item difficulty and item discrimination was carried out.

On this research the grades of 12 multiple-choice exam items were collected: 2 items per year from the Physics and Chemistry exams, 1st phase, from 2003 to 2005. Figure 4.5 shows the number of examinees whose results contributed to this study.

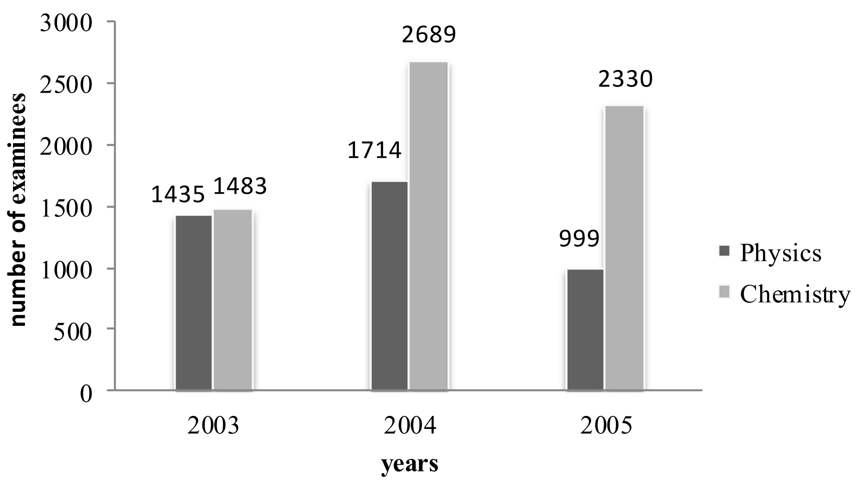

Figure 4.5. Distribution of Physics and Chemistry examinees from 2003 to 2005.

The statistical analysis of the examinees' results encompassed a numerical presentation, which included the item difficulty and the point up to which the items discriminate, and a graphical presentation that relates item scores with content and cognition dimensions. The item difficulty index was obtained from dividing the average grade by the maximum grade assigned to each item, and subtracting 1. On average, for each item, the values of the sample are in the interval between 0.3 and 0.9 – an acceptable value interval according to Doran (1980). Once the results were put in order, the item discriminatory index was calculated, having into consideration two groups with scores between 25% and 35% regarding the highest and lowest ranking. Doran (1980) also emphasized that the values of the item discriminatory index must be equal to or greater than 0.3, which was the case in this sample of twelve items.

The selection of the twelve items was based in two criteria: the two Physics contents and the two Chemistry contents belong to different curricular units, and those contents were included in the 1st phase, 1st call exams from 2003 to 2005. The twelve multiple-choice items selected are found in Appendix 2 along with their solutions.

The 12th grade Physics curriculum starts with an integrated approach to Kinematics and Dynamics of the material particle moving along a plane and, later on, of a system of particles, without neglecting the inherent energy aspects. Then, in rotation motion, fundamental aspects such as variation and conservation of the angular momentum (Newton's Law of Rotation) are studied but with no special focus on the kinematics of rotation. The first unit ends with a brief study of fluid mechanics. The practical applications suggested in the activities give a real dimension to the concepts approached previously. The second unit begins with the study of gravitational and electrostatic interactions, emphasising Newton's theory of universal gravitation as the first attempt to unify the forces of nature. Next, students are expected to learn that the interactions between particles can be described using the unifying concept of field, which requires a greater level of abstraction due to its complexity.

Following this train of thought the study of the conservative, gravitational, and electrostatic fields continues followed by the study of the non-conservative fields and magnetic fields. It is important to stress that, regarding an inertial referential, resting electrical charges only create an electrical field, $\vec{E}$ (electrostatic field), and moving electrical charges create both an electrical field, $\vec{E}$ and a magnetic field, $\vec{B}$ i.e., an electromagnetic field. This unit deals only with the electromagnetic field of a stationary current as its negligible $\vec{E}$ component is reduced to the $\vec{B}$ component (stationary magnetic field or magnetostatic field). In a scientific and technological approach, the historic approach and the study of countless phenomena of the students' everyday life are also relevant. Keeping the curriculum in mind, there were six exam items selected regarding the two contents of each of the units (Unit 1 – 2E – Rotational Motion and Unit 2 – 1 – Gravitation) appearing in the 2003, 2004, and 2005 exams.

The organization of the contents of these two Physics curricular units is systematized in table 4.10.

Table 4.10. Summary of the contents of the 12th grade Physics curriculum.

Curricular Units	Themes	Sub-themes
1 – Forces and Motion	1	A – Motion of a particle under a constant force. Relative motion.
		B – Motion of a particle under bonding forces.
		C – Motion of a particle under forces of attrition.
	2	D – Translational Motion
		E – Rotational Motion
	3	F – Hydromechanics. Hydrostatics.
2 – Interactions and Fields	1, 2	A – Gravitation and Electrostatics
	3	B – Stationary Electromagnetic Field

The 12th grade Chemistry curriculum begins with an understanding of the electronic structure of atoms and of chemical bonds in terms of experimental data along with some basic concepts of Quantum Mechanics. It then progresses into a brief analysis of inter-molecular bonds with the study of gas equations. These first units, with a mainly structural character, are followed by a brief study of organic compounds, connecting atomic structure and reactions. The study of chemical reactions proceeds in the next unit with a deeper knowledge of chemical equilibrium. It is then time to do an interpretation of the extension of the reactions centred in two fundamental physical principles – energy and entropy. The last unit reinforces the acknowledgement of the interfaces between Chemistry, Technology, and Society. The Chemistry contents of the exam items analysed belong to Unit 2 (Inter-molecular Bonds and Gas Laws), and Unit 5 (Energy and Entropy in Chemical Reactions).

The organization of the contents of these two Chemistry curricular units is systematized in table 4.11.

Table 4.11. Summary of the contents of the 12th grade Chemistry curriculum.

Curricular Units	Themes	Sub-themes
1 – Atomic and Molecular Structure	1.1	Atomic and molecular electronic structure: experiments
	1.2	Quantum Mechanics and atomic electronic structure
	1.3	Molecular Orbitals
2 – Inter-molecular Bonds and Gas Laws	2.1	Inter-molecular Bonds
	2.2	Gas Laws
	2.3	Steam pressure
3 – Organic Compounds	3.1	Relations between structure and properties of organic compounds
4 – Extension of Chemical Reactions	4.1	Rate of reaction
	4.2	Equilibrium in Homogeneous and Heterogeneous Systems
	4.3	Equilibrium and Solubility
	4.4	Acid-base Equilibrium
	4.5	Redox (reduction-oxidation) reactions
5 – Energy and Entropy in chemical reactions	5.1	Heat and Work in chemical reactions
	5.2	First Law of Thermodynamics
	5.3	Heat of reaction and Hess Law
	5.4	Second Law of Thermodynamics

The categories used to define content and cognition levels of the Physics and Chemistry items were supported by the revised Bloom's taxonomy, which was applied also in other studies (Anderson & Krathwohl, 2001; Ding, 2007, p. 91; Haladyna, 2004; Krathwohl, 2002). There are two dimensions considered in the revised Bloom's taxonomy: content and cognition. In this study the first three levels for each of these dimensions were considered sufficient to classify all the items (Fig. 4.6).

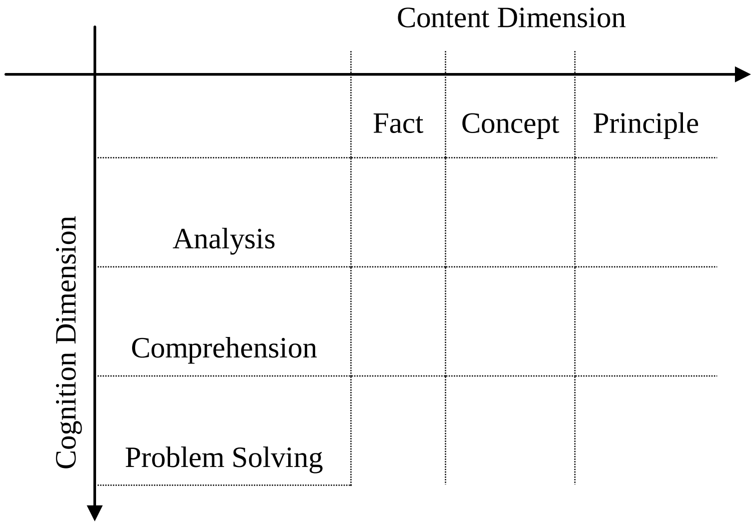

Figure 4.6. Bloom's taxonomy – adapted from Ding (2007, p. 104)

As previously mentioned, the categories used in the definition of the content levels only measure the knowledge required for the resolution of the selected items. Usually, the resolution of an item (see items in appendix 2) requires a reasonable number of steps (step reasoning process), and in all twelve items that number does not go above five steps. In these exams, all the items referring to the selected contents measure higher-level thinking, i.e., they require the application of a concept or principle, instead of facts, i.e. low-level thinking, so common in the items found in the 1960s. In the definition of the three cognition behaviour levels, beyond analysis and comprehension, the term problem solving was adopted as it was deemed more appropriate for the items studied.

Two teachers – two authors of some of the selected exams – were chosen to set content and cognitive levels. First they classify the content dimension, and then proceed to classify the cognition dimension and the item difficulty. The classifications of both judges were not always the same but the reliability was above 90% both in the content dimension (92%), and cognition dimension (95%). Table 4.12 and Table 4.13 show the classification results for the twelve items, six in Physics and six in Chemistry.

Table 4.12. Classification results for the Physics (P) items.

	Physics					
	Unit 1 – 2E Rotational Motion			Unit 2 – 1 Gravitation		
	P1	P3	P5	P2	P4	P6
Cognition level	Principle	Principle	Principle	Principle	Principle	Concept
Content level	Problem Solving	Problem Solving	Comprehension	Problem Solving	Problem Solving	Problem Solving
item difficulty	High	Medium	Medium	High	Medium	Medium

Table 4.13. Classification results for the Chemistry (C) items.

	Chemistry					
	Unit 2 -Inter-molecular Bonds and Gas Laws			Unit 5-Energy and Entropy in Chemical Reactions		
	C1	C3	C5	C2	C4	C6
Cognition level	Principle	Concept	Concept	Concept	Principle	Principle
Content level	Problem Solving	Comprehension	Comprehension	Analysis	Problem Solving	Problem Solving
item difficulty	High	Medium	Medium	Medium	Medium	Medium

In this classification it was considered that the item difficulty was low if the failure rate of the examinees was 25% or less. If the failure rate was 75% or higher the item difficulty was high. Regarding the contents, it was found that the resolution of item C2 required, besides the memorized concepts, an analysis of previous conditions, being considered to be “Analysis” and not “Recall.” As it can be seen in the tables, the teachers considered that the items presented a medium difficulty, with the exception of three items, which were considered to have a high difficulty. For a better understanding, a resolution for each of the six physics items and a detailed description of content levels and cognition dimensions is shown in Table 4.14.

Table 4.14. Physics items resolution and description of the content levels and cognition dimensions.

Unit 1 – 2E – Rotational Motion

item	Resolution	Description
P1	A rigid body spins around an horizontal axis with a binary momentum equal to $\vec{M} = I\,\vec{\alpha}$, where $\alpha = \frac{d\omega}{dt}$ consequently $\alpha = 4.0$ rad s^{-2}. Replacing and considering the units (rad s^{-2} $\times$ kg m^2 = m N) one gets M = 0.4 m N.	Principle - since principles are statements of relationship between two or more concepts (momentum principle and rotation acceleration). Problem solving – relates inertia momentum with quantities and standard units.
P3	As we can assume the rims are thin, the inertia momentum of each wheel is given by $I = m\,r^2$, and the relationship between the magnitude of the excerpted force on each wheel F and its respective momentum in relation to the axis of rotation τ is $\tau = r\,F$. Combining this relationship with the relationship between the magnitude of the momentum of the force and the magnitude of the angular acceleration of the wheel $\tau = I\,\alpha$, we get $\alpha = \frac{F}{m\,r}$. Since the value of $\frac{F}{m\,r}$ is the same for both wheels the angular acceleration has a smaller magnitude in the wheel with the biggest radius, hence this one will take longer to stop.	Principle - since principles are statements of relationship between two or more concepts (inertia, forces and rotational acceleration). Problem solving – This task involves the actual or described use of relevant information either to perform exercises or to solve problems in a particular situation. It is a demonstration of comprehension.
P5	Considering $\vec{L} = \vec{r}_1 \times m_1\vec{v}_1 + \vec{r}_2 \times m_2\vec{v}_2$, $\vec{r}_i$ and $\vec{v}_i$ are on the horizontal plane and so the external product vector is vertical and goes up. $\left\|\vec{L}\right\| = 2\,m\,v\,\frac{l}{2}$ with $v = \omega\frac{l}{2}$ comes $\left\|\vec{L}\right\| = \frac{1}{2}\,m\,l^2\,\omega$.	Principle - since principles are statements of relationship between two or more concepts, (the momentum principle and the rotational speed). Comprehension – relates the rotational momentum expression with a schematic representation.

Unit 2 – 1 (Gravitation)

item	Resolution	Description
P2	The potential difference between A and B is given by $V_A - V_B = \frac{W_{A \to B}}{m}$ (work performed by the field forces in the transport of a particle with mass *m* from A to B). But for *m* > 0 the gravitational force is downward and equal to $F_g = m \times a_g$, so $W_{A \to B} = F_g \times \Delta h = mg \times \Delta h$. Therefore, $V_A - V_B = g\,\Delta h$ (or considering $\Delta V_g = \frac{\Delta E_P}{m}$ with $E_P = m\,g\,\Delta h$ comes $\Delta V_g = g\Delta h$).	Principle - since principles are statements of relationship between two or more concepts, for example, the gravitation potential, work and energy. Problem solving – involves the use of information such as gravitation potential, work and energy to find an equation.
P4	The force acting on the satellite is the force of Earth's gravity and is centripetal. As the movement is presumed to be circular, the satellite's acceleration is, in magnitude, $a = \frac{v^2}{r}$, where $r = r_E + h$. Using the Newton's 2nd Law, in the scalar form $F = m_s\, a$ where *F* is the force of gravity between Earth and the satellite, comes $G\frac{m_E\, m_s}{r^2} = m_s\, a$. Replacing, $a = G\frac{m_E}{(r_E + h)^2}$.	Principle - since principles are statements of relationship between two or more concepts, for example, Newton's second Law, Gravitation and rotation speed. Problem solving – involves the use of information such as Newton's second Law and the rotation speed to find an equation.
P6	The gravitational potential created by any punctual body with mass *m* at distance *r* is given by $V_g = -\frac{G\,m}{r}$. Since $V_g = 0$ at $r = \infty$ and V_g decreases when the distance to mass that created it decreases, $V_B - V_A = -Gm\left(\frac{1}{r_B} - \frac{1}{r_A}\right)$.	Concept – application of a concept - the gravitation potential. Problem solving – involves the application of the gravitation potential concept, considering two points, A and B.

Table 4.15 shows a resolution for each of the six chemistry items and a detailed description of the content levels and cognition dimensions.

Table 4.15. Chemistry items resolution and a description of the content levels and cognition dimensions.

Unit 2 - Intermolecular Bonds and Gas Laws

item	Resolution	Description
C1	The initial mix has an initial pressure of $p = 1$ atm and holds a total number of moles n = 0.5 mol and the final mix has a total number of moles n = 0.75 mol. Given that the volume and temperature remain constant we have, following the ideal gas equation, that the final pressure of the mix is 1.5 atm.	Principle – relates two concepts – representations of chemical equations and the ideal gas law. Problem solving – involves the interpretation of a chemical equation related with ideal gas law to solve a problem.
C3	According to the picture, at a pressure of 1 atm and a temperature of 25º C, water is found in its liquid state and all other gases are in the gaseous state, since their boiling temperature is lower than 25º C.	Concept – involves knowledge about concepts such as state of matter connected with values of temperature. Comprehension – required students to interpret a graphical representation on temperature.
C5	Keeping the pressure and temperature constant, the volume of a sample of an ideal gas is directly proportional to the quantity of gas, n, in the sample.	Concept – application of a concept - the ideal gas law. Comprehension– requires an individual to interpret the variations of the ideal gas law.

Unit 5 - Energy and Entropy in Chemical Reactions

item	Resolution	Description
C2	The concept of equilibrium implies that the system remains unchanged from a macroscopic point of view, i.e., its macroscopic properties do not vary with time, so that entropy remains constant while the equilibrium remains unchanged.	Concept – application of a concept – equilibrium in chemical reactions. Analysis– requires a student to retrieve the concept of equilibrium in chemical reactions from memory.
C4	In a closed system, energy conservation implies $$Q = \Delta U - W \ .$$ In the conditions mentioned we have $Q > 0$, since the reaction is endothermic, and $W > 0$, since there is a reduction of the system volume, then $\Delta U > 0$.	Principle – relates two concepts – internal energy and entropy in chemical reactions. Problem solving – relates energy to a change in entropy of a given system to solve a problem.
C6	"If two moles release 113 KJ (ΔH = - 113 kJ)", then by Reading the chemical equation for each mole of NO (g) consumed, 56.5 kJ are released as heat.	Principle – relates two concepts – representations of chemical equations and variations of energy in chemical reactions. Problem solving – involves the interpretation of a chemical equation related with entropy of a given system to solve a problem.

This classification shows that 83% of the items in the Physics exams require higher-level thinking, be it by solving problems or by presenting contents relating one or more concepts. The item classified as "comprehend" interrelated the rotational momentum expression with a schematic representation. On the other hand, the item classified as "problem solving" required the application of the gravitation potential concept, considering two points, A and B.

Even though 50% of the items require problem solving, the analysis of the results shows that, on the six Chemistry items (figure 4.8), in the content dimension, the classification divides the items between the concept and principle levels. The item classified as “analysis” required students to retrieve the concept of equilibrium in chemical reactions from memory.

In summary, the classification of the twelve selected items by the two teachers showed that those items mainly focus on higher-level thinking, in both content and cognition dimensions.

The use of a vast and diverse range of methodological instruments in conjunction with a flexible selection, volume and heterogeneity of the collected information, make for some of the identifying marks of a case study. The triangulation of methods and empirical data leads to an exploratory initial study of the performance of students in schools from the Greater Lisbon area, which is then broadened to include all of the national results, thus becoming more than a simple case study.

The four basic types of triangulation mentioned by Dezin (1978) are highlighted in this study: data triangulation (resorting to several data sources); researcher triangulation (participation of several judges/graders); theory triangulation (resorting to multiple perspectives to analyse item types), and methodological triangulation (resorting to several methods to study a particular problem).

The potential and the virtues of this study cannot hide the limitations that a methodological strategy such as this one encompasses. As such, the establishment of triangulation of data, sources, and methods is the guarantee of its internal legitimacy.

5 Results and Discussion

“WYTIWYG: What you test is what you get.” (Resnick & Resnick, 1989)

In this chapter the treatment and analysis of the data tried to integrally respect the assumptions and objectives attached to the Research Work. The data regarding test questions and exam results were extracted, compiled, and grouped in regards to timeframe, according to the proposed methods. There are several methods of analysing the performance of the examinees compared to the expectations created during the school year.

The choice of the Contrasting Groups Method, proposed by Beuk (1976), “centred on the student”(Kane, 1995) came from its simple implementation and easy understanding. The examinees were initially divided into two or more distinct groups, based on an evaluation centred on their knowledge and skills. For instance, for internal students the selection was done by thousands of teachers who, by awarding each of them an internal final grade (IFG), allowed the identification of a group of examinees with a performance clearly below a certain threshold, and another group of examinees that is above that same threshold. It is not a question of labelling the groups in regards of their internal final grade, but of observing to which point this grade is consistent with the exam grade.

Keeping in mind the collected data, the Beuk Method (Beuk, 1984) was applied to a total of 15 exams distributed by three groups and allowed, based on a survey done by ten teachers, to estimate the minimum performance level for those exams and a grade for the internal students. The results of the survey, the average achieved, the standard deviation, and a graphical representation can be found in this chapter.

The Extended Angoff Method is commonly used in 12th grade level evaluations (1988, p. 264) as it includes complex evaluations involving mixed format items. In the simplest implementation of this method, a teacher panel estimated the probability of a certain group of students answering correctly to each exam item. The average of the teacher estimates allowed estimating a grade to differentiate the performance of two groups of students and to compare the estimated average grade for each item with the average grades achieved by a group of examinees.

The mathematical procedure used for the grading teacher estimates was identical to the Contrasting Groups Method, both in the calculation of averages and logistic regression model, and in the software used. At the end of each sub-section there is a comparison of the cut scores obtained through the different methods.

In the item contents and cognition analysis it is shown that the 12 selected items mainly require a high reasoning level. The results of the two dimensional classification show that 83% of the Physics items require a high level of reasoning, both through problem solving and through the presentation of contents involving one or more concepts. Regarding Chemistry, even though 50% of the items require problem solving, in the contents dimension the classification divides the items between the concepts and principles levels. This can be a possible explanation for the results of the students not satisfying the expectations.

5.1 Contrasting Groups Method

The frequency values shown in Appendix 2 (Tables 6.1 through 6.21) allowed plotting the graphics below. The horizontal axis gives information regarding the exam grades, distributed according to the reference grades and, in the vertical axis, the proportion of each group belonging to the interval represented by each of the reference grades is indicated. The calculations were made assuming that all the values of a class are tacked as its midpoint.

The graphic representation of external/internal students and, simultaneously, for the years of 1960, 1965, 1969, 1972, 1982, 1983, 1984, 2004, and 2005, of the distribution of the internal examinees subdivided in barely competent/other internals confirmed the existence of distinct student groups and allowed to get a cut score graphically. The MCGM1, MCGM2, and linear regression (every time it was possible) methods were applied and the following tables show the results with the appropriate comments.

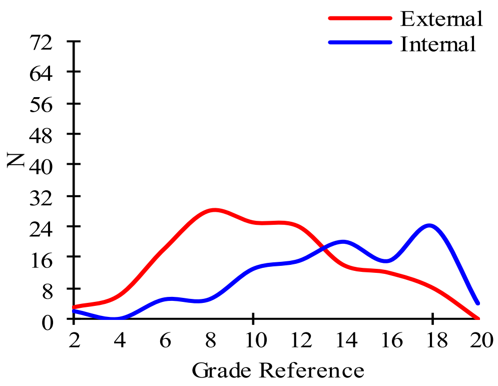

Figure 5.1. School 1 - 1950 2nd cycle

CUT SCORE	
MCGM1	11.4
MCGM2	10.6

Comment: The new curriculum began to be evaluated. The results were negative in many schools when compared to the Physical-Chemical Sciences exam of the previous year. The first criticisms were brought forward. Upon getting a grade of 16 or higher, examinees were excused from the oral examination.

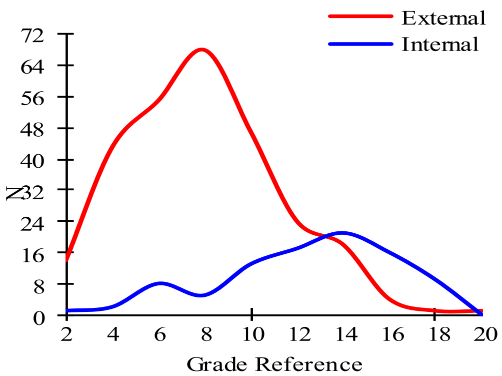

Figure 5.2. School 1 - 1951 2nd cycle

CUT SCORE	
MCGM1	9.4
MCGM2	9.2
Linear Regression	8.3

Comment: The exam had the old curriculum questions regarding chemical formulas. The national results were negative and raised considerable criticism. The written exams incorporated the laboratory component, as there was no laboratory exam.

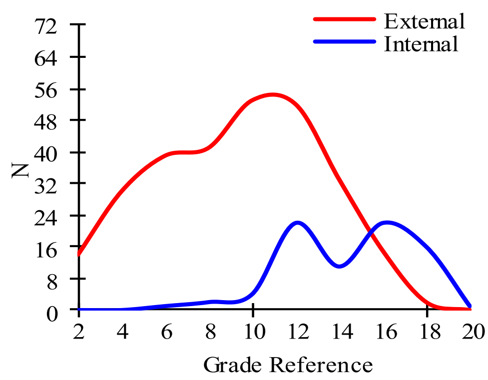

Figure 5.3. School 1 - 1953 2nd cycle

CUT SCORE	
MCGM1	10.5
MCGM2	11.0
Linear Regression	9.9

Comment: The external examinees obtained, on average, negative scores due to, according to some, a poor laboratory preparation. Students are now excused from the oral exam if they achieve a grade of 14 or higher.

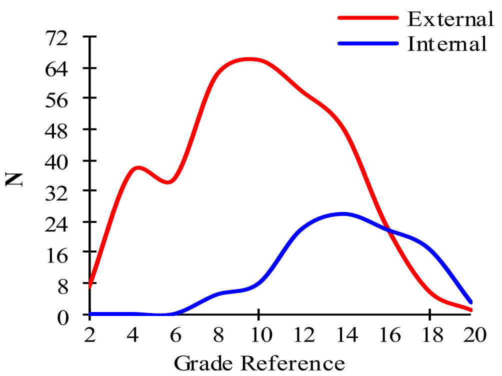

Figure 5.4. School 1 - 1954 2nd cycle

CUT SCORE	
MCGM1	11.4
MCGM2	11.1

Comment: The private educational institutions began to pressure the government to conduct the national examinations. On the other hand, the negative results led to a curriculum change.

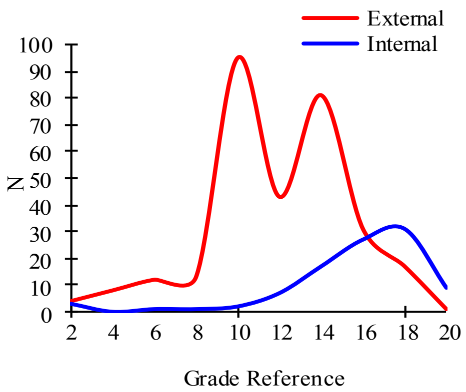

Figure 5.5. School 1 - 1956 2nd cycle

CUT SCORE	
MCGM1	13.5
MCGM2	13.2

Comment: With major changes in the curriculum in 1954, the grades improved.

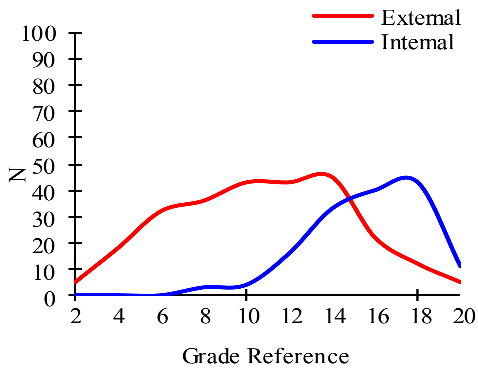

Figure 5.6. School 1 - 1960 2nd cycle

CUT SCORE	
MCGM1	12.4
MCGM2	12.3
Linear Regression	12.1

Comment: The number of external examinees declined in 1957 due to the legalization of the examinations in private institutions.

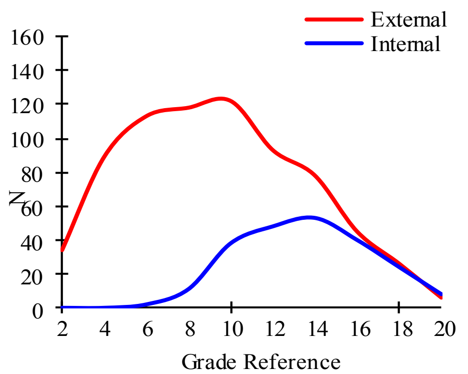

Figure 5.7. School 1+ 2 - 1965 2nd cycle

CUT SCORE	
MCGM1	10.4
MCGM2	10.5

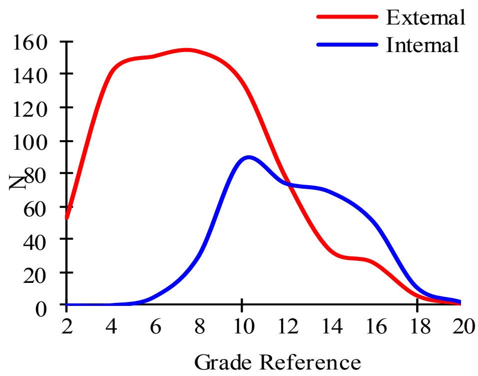

Figure 5.8. School 1+ 2 - 1967 2nd cycle

CUT SCORE	
MCGM1	8.9
MCGM2	9.1
Linear Regression	7.5

Comment: In 1963 new rules were introduced in the preparation of exams, but by the end of the decade the structure and type of items remained unchanged. School 2 is located outside of Lisbon and contributed to the high number of external students, because many private schools outside the capital were unable to conduct exams. The failing rate of internal students was residual.

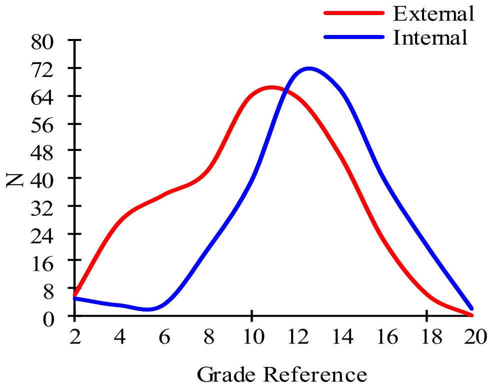

Figure 5.9. School 1 - 1970 2nd cycle

CUT SCORE	
MCGM1	11.2
MCGM2	10.8

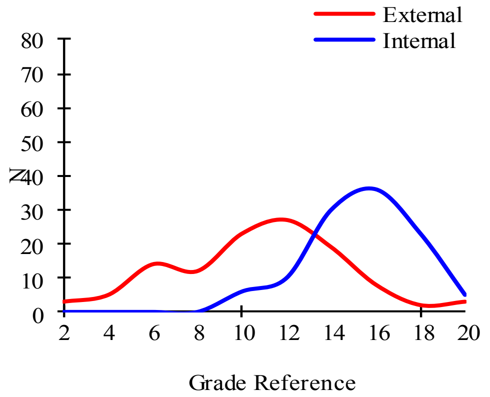

Figure 5.10. School 1 - 1972 2nd cycle

CUT SCORE	
MCGM1	12.5
MCGM2	12.2
Linear Regressio	13.1

Comment: From 1969, students could continue their studies even if they had a grade of 9.5. The number of examinees towards the end of the decade shows the beginning of the movement of city dwellers to the outskirts and a selection of the examinees.

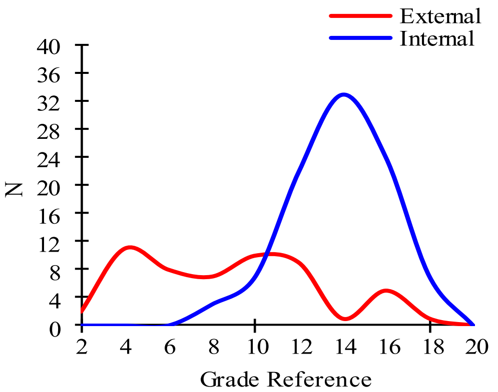

Figure 5.11. School 1 - 1973 2nd cycle

CUT SCORE	
MCGM1	10.4
MCGM2	10.3

Comment: It was the last exam before the revolution of 1974, with positive results.

Figure 5.12 shows the variation of the cut scores obtained through MCGM1 and MCGM2.

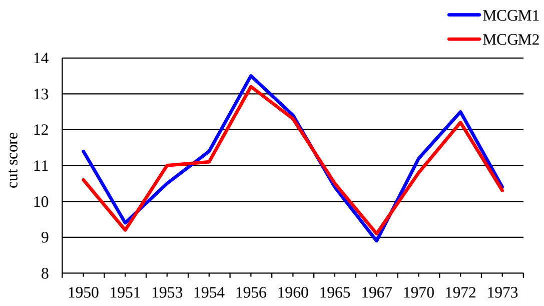

Figure 5.12. Cut scores obtained by MCGM1 and MCGM2, for the 2nd cycle, between 1950 and 1973.

Figure 5.12 shows that there are no big differences between the cut scores calculated through MCGM1 and MCGM2. This fact reveals some symmetry in the frequency distribution of the exam grades, although the median (MCGM1) is not as sensitive as the average (MCGM2) to the observations that are much higher or much lower than the rest. Still it can be seen that the average tends to be lower than the median, i.e., the sample is skewed to the left due to the exam grades achieved by the external students. In the beginning of the Pires de Lima Reform, there were a large number of examinees from private schools that would self-propose to public schools as external students due to legal constraints. These students had a high fail rate when compared to the internal examinees.

It is interesting to verify that the 1950 exam does not display the expected content rupture when compared to the contents of the previous reform, leading to positive cut scores. The same cannot be said of the 1951exam, where an approach bound to the Pires de Lima Reform led to considerably lower exam grades and, consequently, to a negative cut score. The results of this exam stirred up a lot of contestation towards the exam amongst the media, which was only appeased with the good results achieved in the 1956 exam.

In 1953, the cut score calculated with MCGM2 (from the averages of the EG) is higher than the one obtained from MCGM1. One of the possible causes is the performance of the external students, who were in great number at this central Lisbon school. With the increase of compulsory schooling in the late 1960s to the 6th grade, the number of internal examinees increased and, consequently, so did the number of grades above 10.

In the early 1970s the number of external students decreases and the cut score increases. Still, when the distribution is symmetrical the average and median is similar.

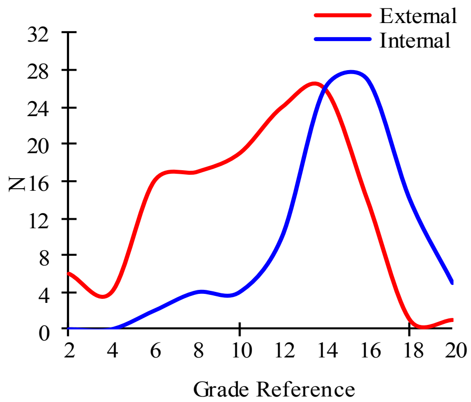

Figure 5.13. School 1 - 1949 3rd cycle

CUT SCORE	
MCGM1	12.0
MCGM2	12.3
Linear Regression	11.8

Comment: It was the first Physical-Chemical Sciences exam of the 3rd cycle after the Pires de Lima Reform. A small number of students attended the 3rd cycle of High School and their performance was good.

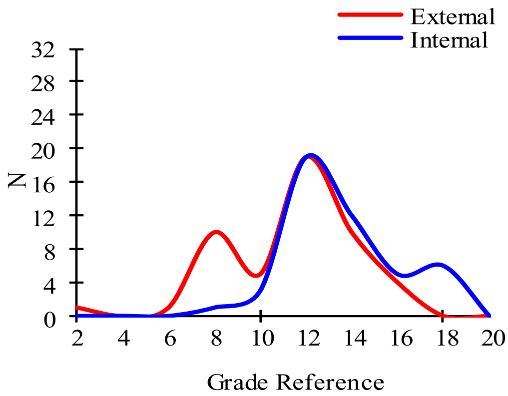

Figure 5.14. School 1 - 1954 3rd cycle

CUT SCORE	
MCGM1	11.8
MCGM2	11.9

Comment: The examinees achieved a good result in the written exam. There was some media contestation regarding the oral and laboratory exams.

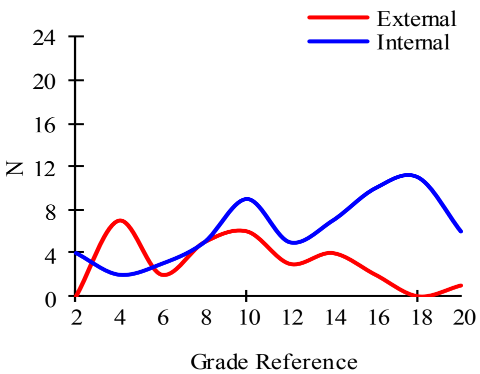

Figure 5.15. School 1 - 1955 3rd cycle

CUT SCORE	
MCGM1	11.0
MCGM2	10.6

Comment: Unlike the previous years, there was a decrease in the performance of internal students.

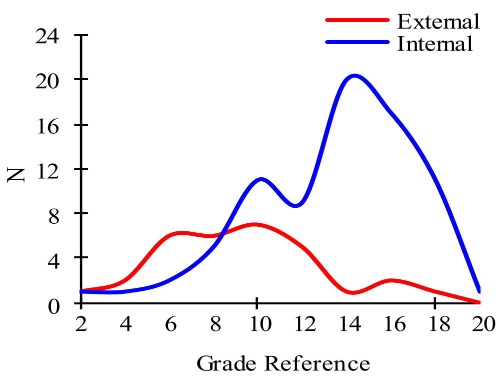

Figure 5.16. School 1 - 1956 3rd cycle

CUT SCORE	
MCGM1	10.7
MCGM2	10.9

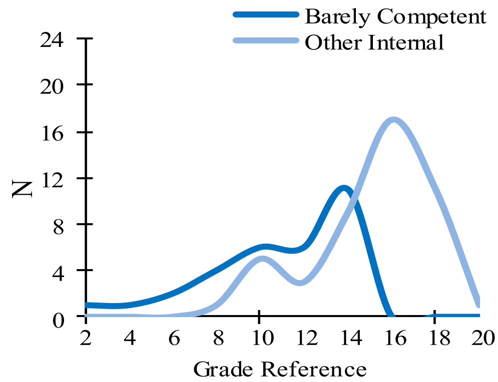

Figure 5.17. School 1 - 1956 3rd cycle

CUT SCORE	
MCGM1	10.1
MCGM2	10.1

Comment: The cut scores calculated through the median (MCGM1) and through the average (MCGM2) are very similar. The cut score decreases when only the internal students are considered.

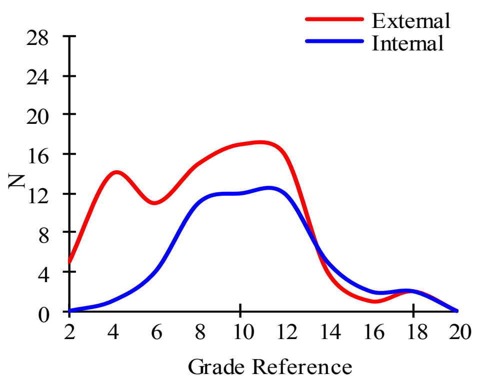

Figure 5.18. School 1 - 1959 3rd cycle

CUT SCORE	
MCGM1	8.7
MCGM2	8.7

Comment: This exam revealed the worse results of the decade. On one hand the number of low performance external examinees increased, on the other hand the internal students had trouble with the calculations and in point II (surface tension of a liquid).

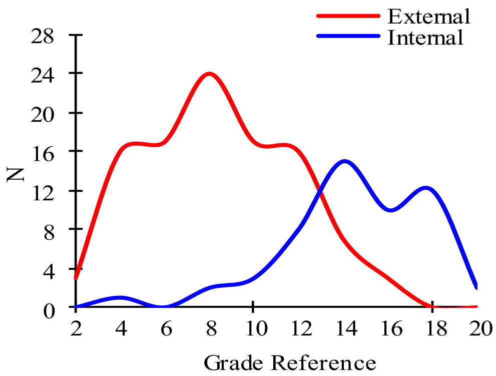

Figure 5.19. School 2 - 1960 3rd cycle

CUT SCORE	
MCGM1	10.6
MCGM2	10.7

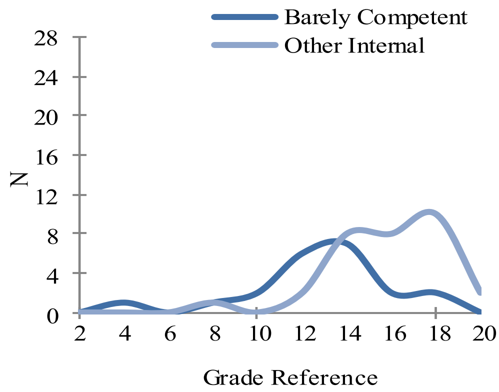

Figure 5.20. School 2 - 1960 3rd cycle

CUT SCORE	
MCGM1	12.4
MCGM2	13.1

Comment: When considering all the examinees the cut score showed improvement and got closer to the values of 1956. The grades of the internal students were positive. Keeping in mind that school 2 is outside of Lisbon, the number of external examinees increased.

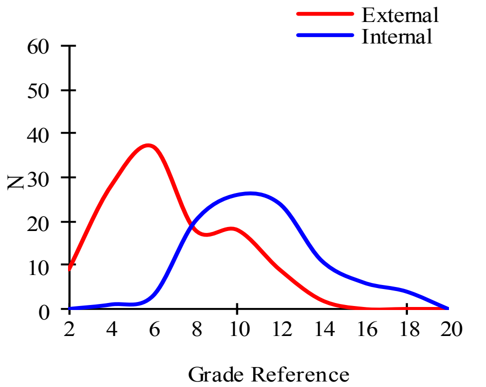

Figure 5.21. School 2 -1961 3rd cycle

CUT SCORE	
MCGM1	7.7
MCGM2	7.9

Comment: The number of examinees increased. These were the worst grades since the start of the reform. This exam included simple questions, i.e., the association of resistances in series and in parallel.

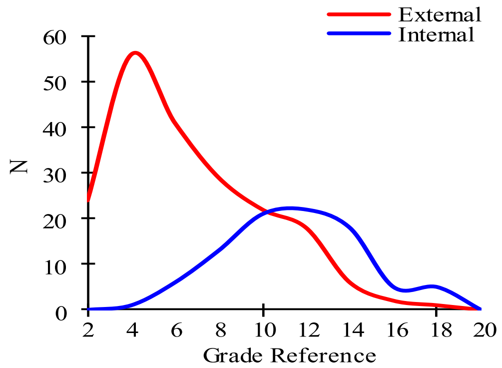

Figure 5.22. School 2 - 1964 3rd cycle

CUT SCORE	
MCGM1	7.7
MCGM2	8.0
Linear Regression	8.9

Comment: The exam keeps the same structure and contents of the previous ones and an improvement in the grades of internal students versus external students can be observed.

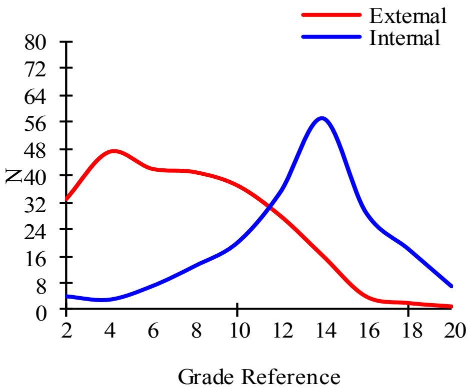

Figure 5.23. School 1+ 2 - 1965 3rd cycle

CUT SCORE	
MCGM1	9.3
MCGM2	9.3
Linear Regression	8.8

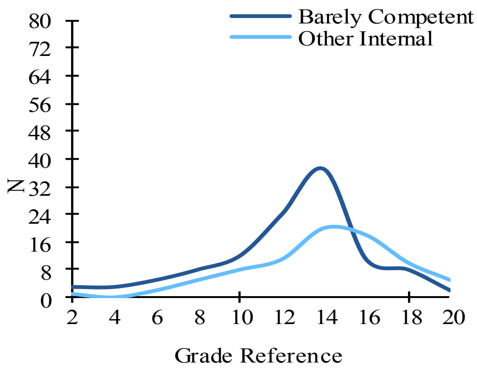

Figure 5.24. School 1+ 2 - 1965 3rd cycle

CUT SCORE	
MCGM1	11.3
MCGM2	12.0

Comment: In order to include a higher number of examinees, two schools were considered. The cut score for all the examinees improved but was still negative. The cut score for internal students decreased when compared to 1960.

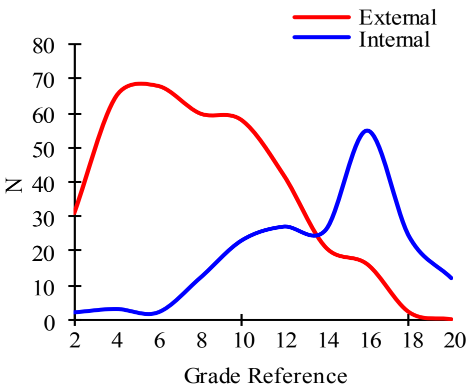

Figure 5.25. School 2 - 1966 3rd cycle

CUT SCORE	
MCGM1	9.5
MCGM2	8.1
Linear Regression	7.0

Comment: The increase of examinees in school 2 continues with mainly external students and the cut score decreases.

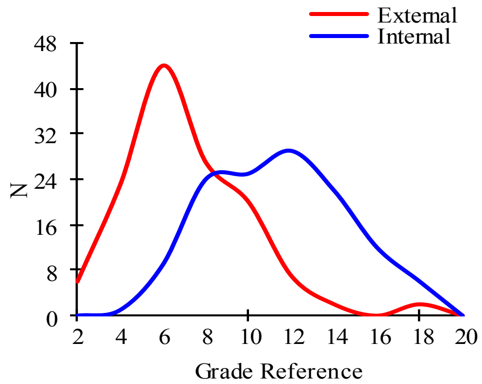

Figure 5.26. School 2 - 1969 3rd cycle

CUT SCORE	
MCGM1	8.1
MCGM2	9.1
Linear Regression	8.2

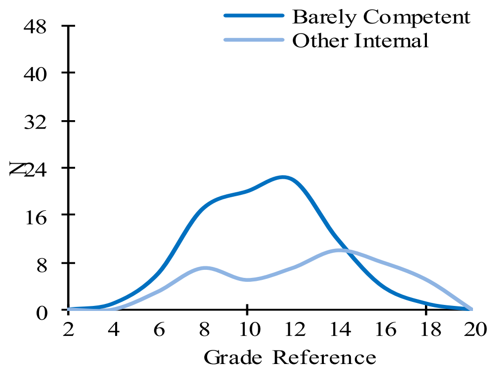

Figure 5.27. School 2 - 1969 3rd cycle

CUT SCORE	
MCGM1	11.3
MCGM2	11.3

Comment: There are more public schools in the area covered by school 2 and the number of examinees decreases. The cut score still remains negative for all the examinees.

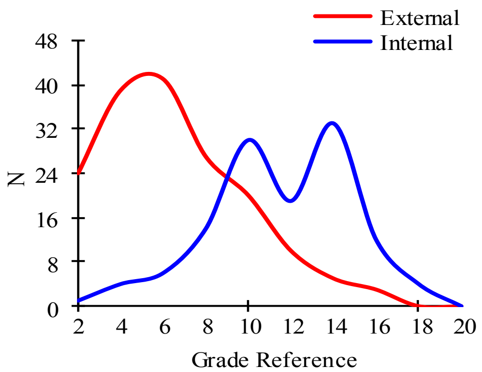

Figure 5.28. School 1+ 2 - 1970 3rd cycle

CUT SCORE	
MCGM1	7.8
MCGM2	8.0

Comment: The cut score continues going down. The grades of external students play a major role in that.

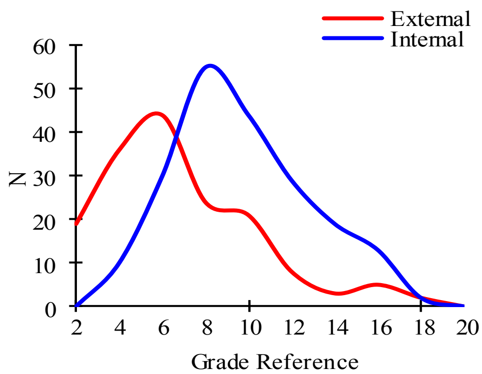

Figure 5.29. School 2 - 1971 3rd cycle

CUT SCORE	
MCGM1	6.9
MCGM2	7.3
Linear Regression	5.6

Comment: The cut score remains negative even though there were no changes in exam structure or contents.

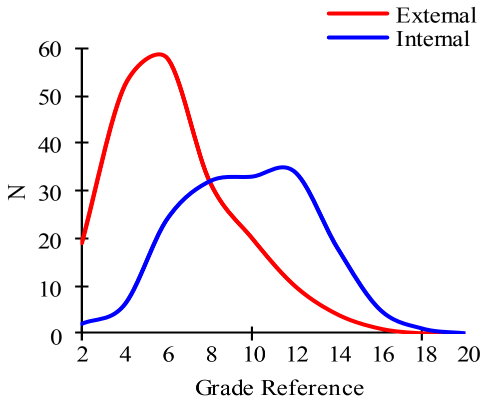

Figure 5.30. School 1+ 2 - 1972 3rd cycle

CUT SCORE	
MCGM1	6.9
MCGM2	7.2
Linear Regression	6.2

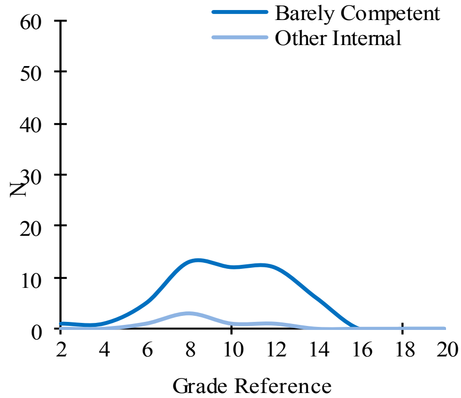

Figure 5.31. School 1+ 2 - 1972 3rd cycle

CUT SCORE	
MCGM1	8.2
MCGM2	8.2

Comment: At the end of a curricular reform it would expect to see an improvement in the exam grades. Considering only school 2 we can see a decrease of the cut score, both for all the examinees and only for the internal students.

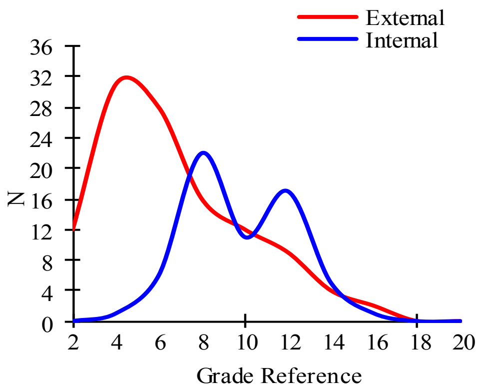

Figure 5.32. School 2 - 1973 3rd cycle

CUT SCORE	
MCGM1	6.6
MCGM2	7.3

Comment: In the last year before the 1974 revolution the cut score stayed basically unchanged when compared to the previous year

Figure 5.33 shows the variation in the cut scores obtained through MCGM1 and MCGM2.

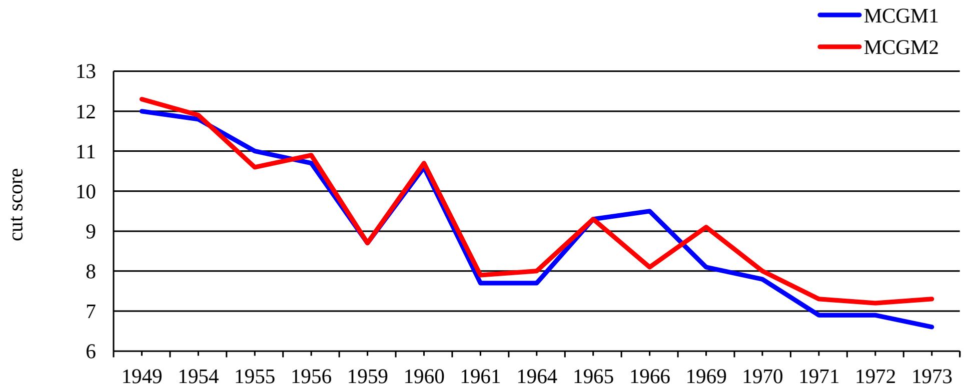

Figure 5.33. Cut scores obtained through MCGM1 and MCGM2, in the 3rd cycle, between 1949 and 1973.

The cut score for the 1st call Physics-Chemistry exams changed throughout the years. As it was previously seen in figure 5.12 there are no big discrepancies between the cut scores calculated using MCGM1 and MCGM2, except in 1966. These samples show less symmetry in the frequency distribution than the 2nd cycle did, leading to inversions of the cut scores obtained through MCGM1 and MCGM2. This fact is very clear in 1966, where the exam grades for external students were very low and the internal students achieved high grades. In general, the grades achieved by the internal students at these two reference schools were high.

For example, from the 1020 enrolled students[21] in the 3rd cycle exams in 1950, in the district of Lisbon, approximately only 1/5 did not fail[22]. The decline began immediately on the 1950 exam due to the item complexity[23].

In this sample we see that the cut score was positive until 1960, with the exception 1959. From that point onwards it became negative and kept decreasing until 1973, independently from the number of examinees. From the tests it is possible to verify that there were no changes in structure or contents that justify this change.

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[21] Published in *Diário de Lisboa*, July 2, 1951, n. 10267, year 31, page 16.

[22] Published in *Diário de Lisboa*, July 17, 1950, n. 9924, year 30, page 7.

[23] Published in *Diário de Lisboa*, June 28, 1951, n. 10263, year 31, page 7

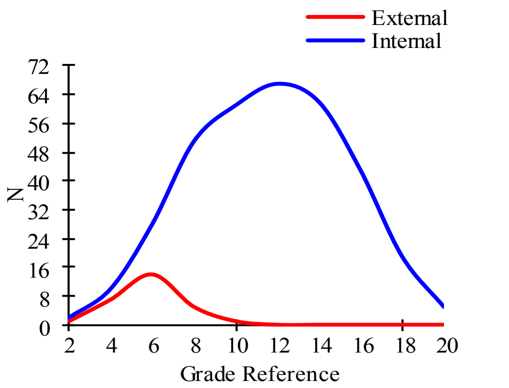


Figure 5.34. School 3 - Physics 1982 12th grade

CUT SCORE	
MCGM1	7.8
MCGM2	11.2
Linear Regression	11.6

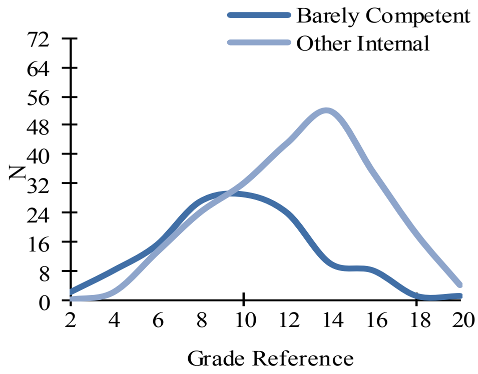


Figure 5.35. School 3 - Physics 1982 12th grade

CUT SCORE	
MCGM1	10.4
MCGM2	10.3
Linear Regression	14.7

Comment: This school gathered students from a privileged area of Lisbon and this was a very popular exam after the extinction of the Propaedeutic Year. There were a high percentage of internal students and the cut score was positive both for internal students and all students.

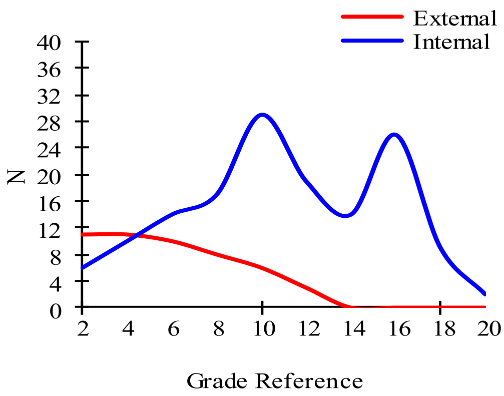


Figure 5.36. School 3 - Physics 1983 12th grade

CUT SCORE	
MCGM1	7.9
MCGM2	7.5
Linear Regression	11.3

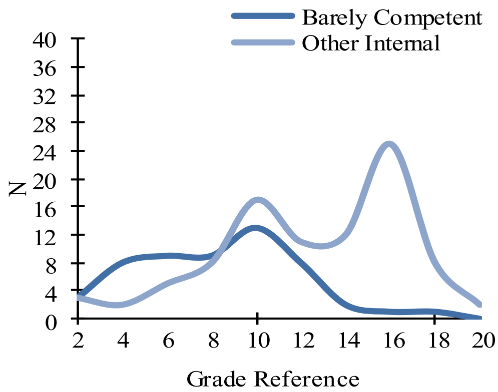


Figure 5.37. School 3 - Physics 1983 12th grade

CUT SCORE	
MCGM1	10.5
MCGM2	8.3

Comment: The opening of new schools led to a decrease in the number of examinees at this school. With the increase of external examinees the cut score for all the examinees was located in the interval between 7 and 8.

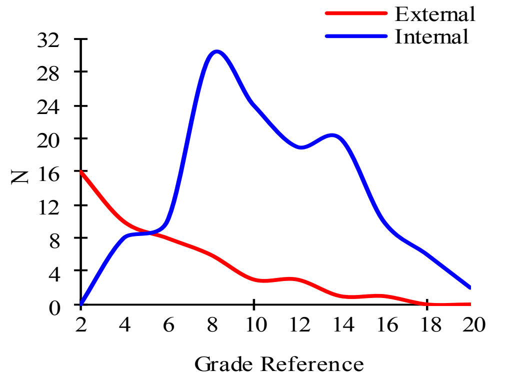


Figure 5.38. School 3 - Physics 1984 12th grade

CUT SCORE	
MCGM1	7.0
MCGM2	7.6
Linear Regression	4.8

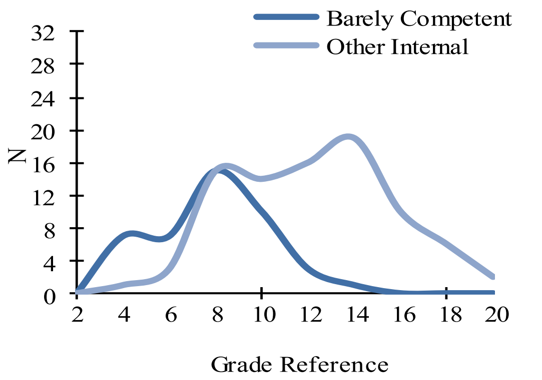


Figure 5.39. School 3 - Physics 1984 12th grade

CUT SCORE	
MCGM1	10.0
MCGM2	9.5

Comment: The number of examinees continued to decrease and the grades, for both the internal students and all the examinees also went down. The cut score remains in the 7 to 8 interval.

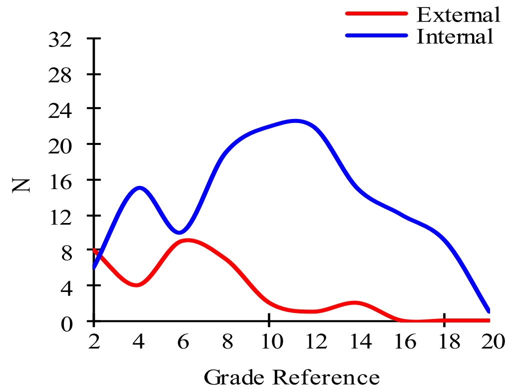


Figure 5.40. School 3 - Physics 1985 12th grade

CUT SCORE	
MCGM1	7.5
MCGM2	7.8
Linear Regression	6.0

Comment: There is greater uniformity of grades when compared to the previous year. The cut score stays in the 7 to 8 interval.

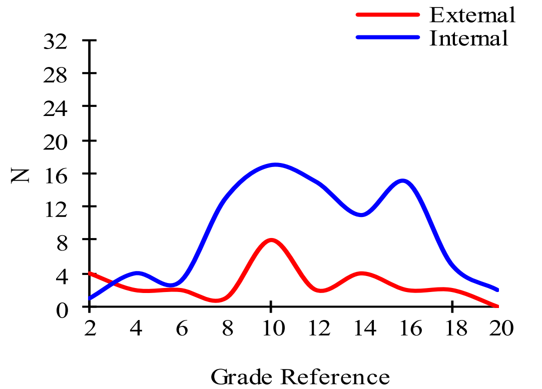


Figure 5.41. School 3 - Physics 1986 12th grade

CUT SCORE	
MCGM2	10.3
MCGM2	10.5

Comment: With the decrease in the number of external examinees there is an increase in the cut score. Many of the external examinees took the exam to improve their grade.

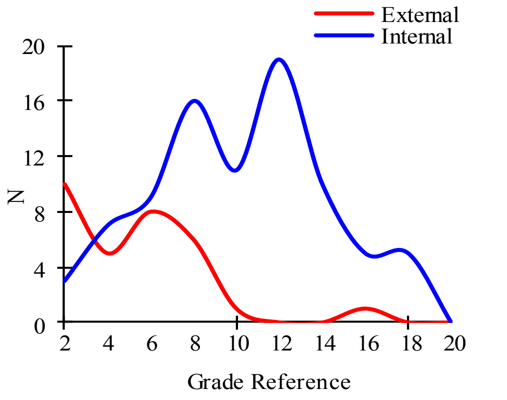


Figure 5.42. School 3 - Physics 1987 12th grade

CUT SCORE	
MCGM1	7.5
MCGM2	7.2
Linear Regression	2.7

Comment: The cut score stays in the 7 to 8 interval.

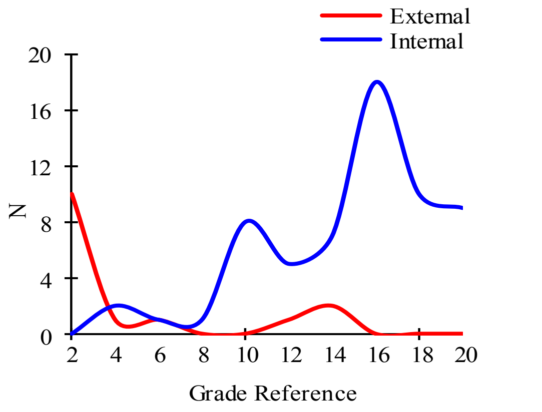


Figure 5.43. School 3 - Physics 1988 12th grade

CUT SCORE	
MCGM1	8.0
MCGM2	9.0
Linear Regression	6.8

Comment: There is a slight increase of the cut score, although it remains negative.

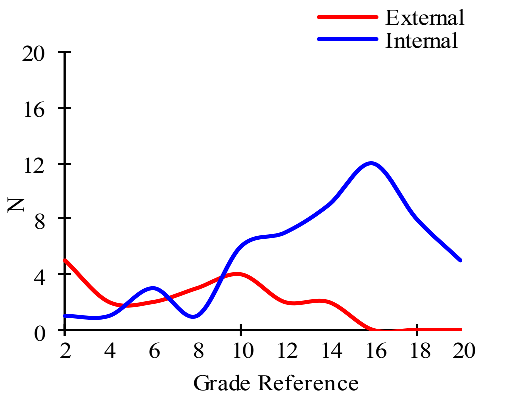


Figure 5.44. School 3 - Physics 1989 12th grade

CUT SCORE	
MCGM1	8.0
MCGM2	9.0
Linear Regression	1.2

Comment: There is almost no variation from the previous year.

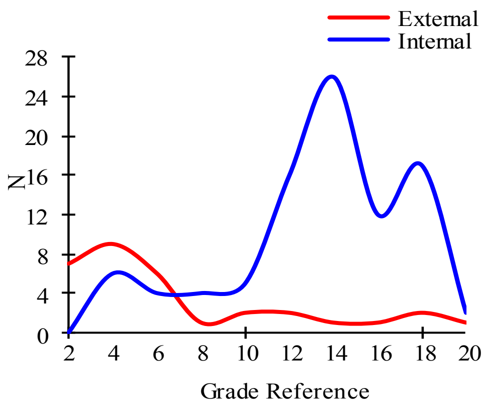


Figure 5.45. School 3 - Physics 1990 12th grade

CUT SCORE	
MCGM1	9.6
MCGM2	8.8

Comment: There is a slight increase in the cut score, although it remains negative.

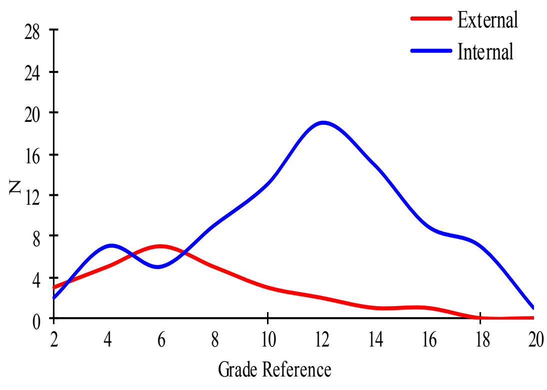


Figure 5.46. School 3 - Physics 1991 12th grade

CUT SCORE	
MCGM1	5.8
MCGM2	5.5

Comment: The number of internal examinees decreased and the cut score is the lowest since 1982.

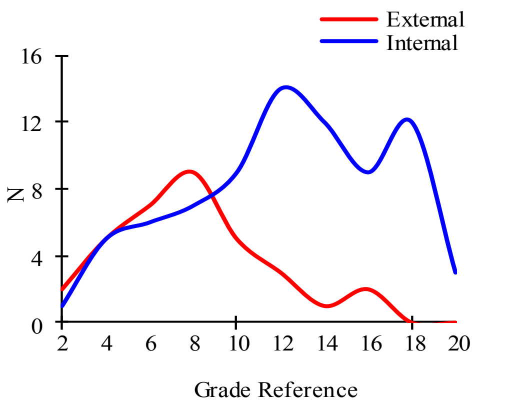


Figure 5.47. School 3 - Physics 1992 12th grade

CUT SCORE	
MCGM1	8.7
MCGM2	9.0

Comment: The cut score was in the 8 to 9 interval, the negative value seen since 1988.

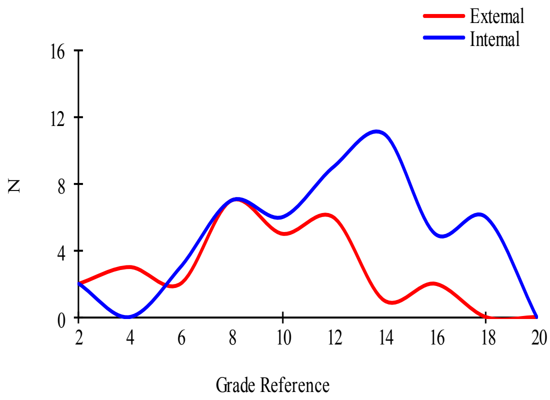


Figure 5.48. School 3 - Physics 1993 12th grade

CUT SCORE	
MCGM1	8.2
MCGM2	9.0

Comment: There is almost no variation from the previous year.

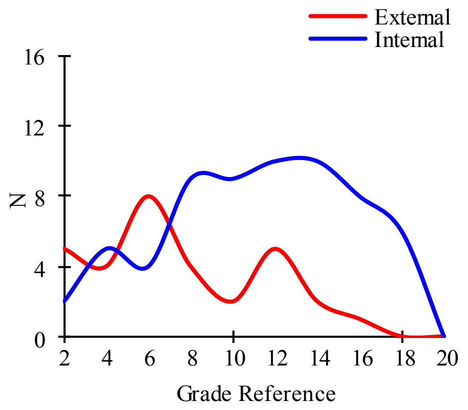


Figure 5.49. School 3 - Physics 1994 12th grade

CUT SCORE	
MCGM1	8.9
MCGM2	9.0

Comment: There is a slight improvement in the cut score when compared to the previous year.

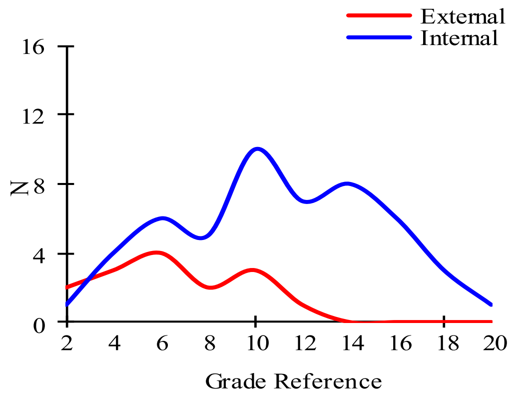


Figure 5.50. School 3 - Physics 1995 12th grade

CUT SCORE	
MCGM1	8.5
MCGM2	8.0

Comment: The cut score decreases.

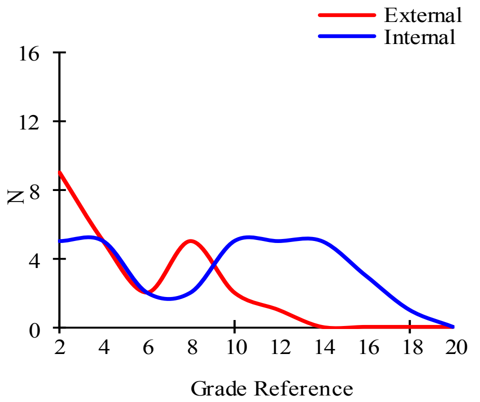


Figure 5.51. School 3 - Physics 1996 12th grade

CUT SCORE	
MCGM1	4.8
MCGM2	7.7

Comment: This was the first exam with code 115 and it had different structure and contents. The examinees had the worst grades since 1982.

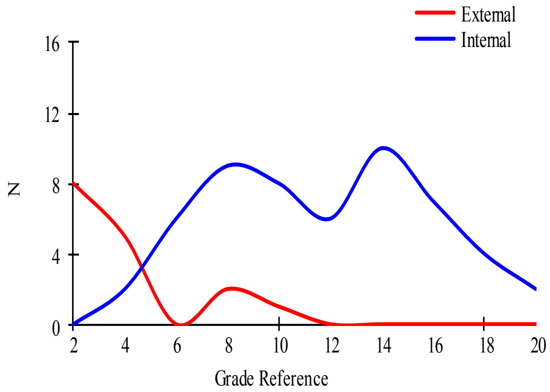


Figure 5.52. School 1+ 4 - Physics 1997 12th grade

CUT SCORE	
MCGM1	7.9
MCGM2	7.8

Comment: There is a slight improvement, still the low grades achieved by the examinees lead to great contestation in the media due to the exam difficulty.

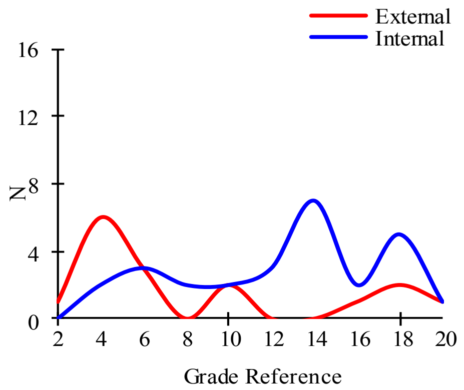


Figure 5.53. School 1+ 4 - Physics 1998 12th grade

CUT SCORE	
MCGM1	9.9
MCGM2	9.1
Linear Regression	7.0

Comment: In this small sample the grades improved but the cut score remained negative.

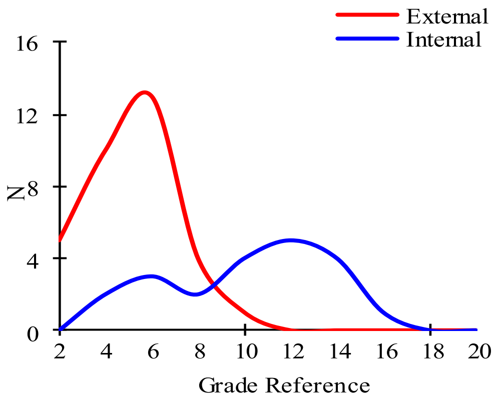


Figure 5.54. School 1+ 4 - Physics 1999 12th grade

CUT SCORE	
MCGM1	6.9
MCGM2	6.8
Linear Regression	7.9

Comment: With the increase of external examinees the cut score decreased.

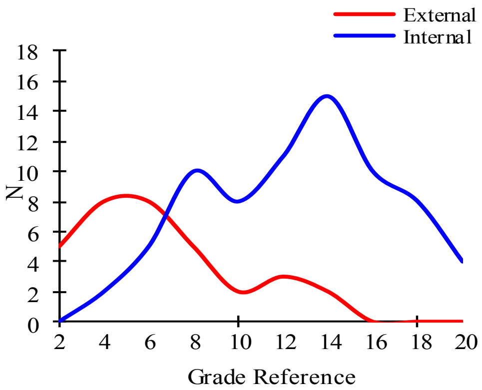


Figure 5.55. School 1+ 4 - Physics 2000 12th grade

CUT SCORE	
MCGM1	8.8
MCGM2	8.6

Comment: There is improvement in the cut score due to the increase of internal examinees.

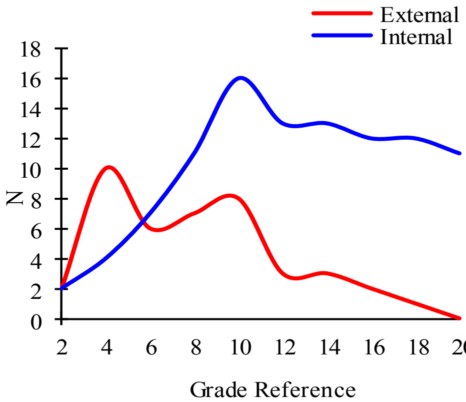


Figure 5.56. School 1+ 4 - Physics 2001 12th grade

CUT SCORE	
MCGM1	9.2
MCGM2	9.5

Comment: The grades of the internal examinees improved the cut score.

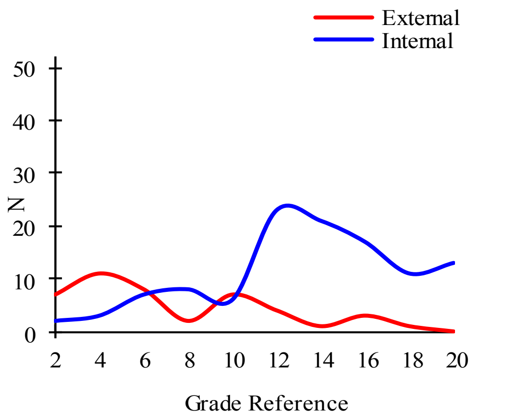


Figure 5.57. 6 schools - Physics 2002 12th grade

CUT SCORE	
MCGM1	9.0
MCGM2	9.4

Comment: The cut score remained negative when considering a bigger number of schools in the Greater Lisbon area.

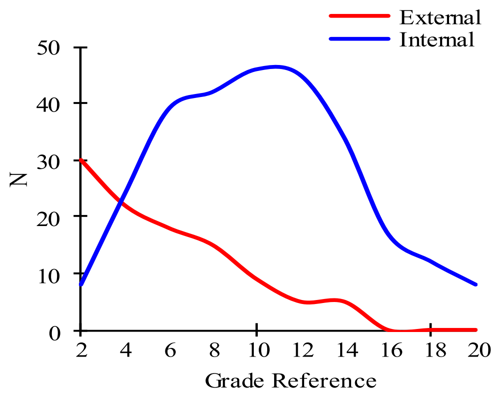


Figure 5.58. 9 schools - Physics 2003 12th grade

CUT SCORE	
MCGM1	8.8
MCGM2	8.8

Comment: There is a significant increase in the number of examinees and the cut score decreased.

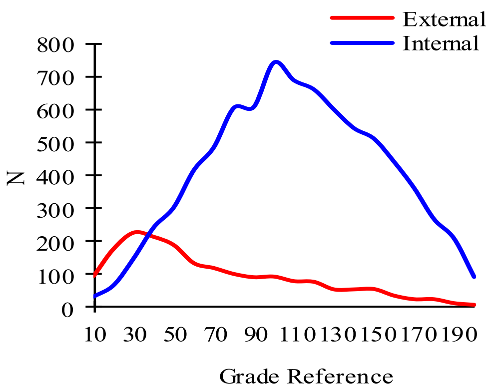


Figure 5.59. ENES Physics 2004 12th grade

CUT SCORE	
MCGM1	7.9
MCGM2	10.4

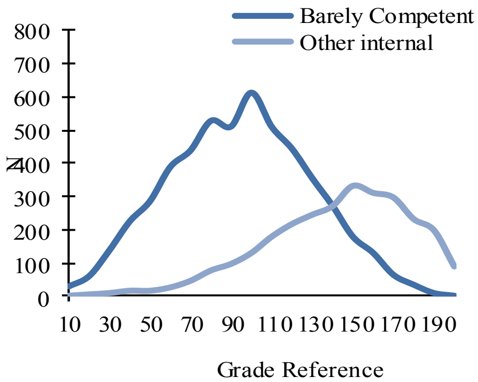


Figure 5.60. ENES Physics 2004 12th grade

CUT SCORE	
MCGM1	11.8
MCGM2	11.4

Comment: Considering all the examinees that did this exam (ENES) [Secondary School National Statistics], the median cut score is negative, while the average cut score is positive for both groups. The cut score for internal students was in the interval between 11 and 12.

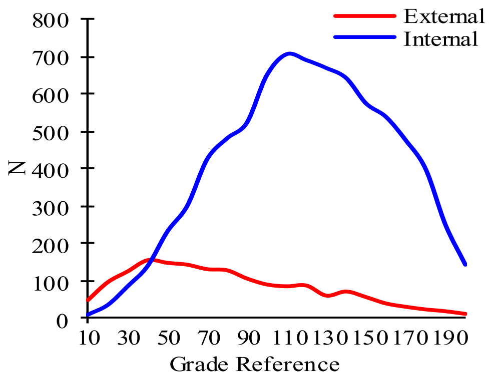


Figure 5.61. ENES Physics 2005 12th grade

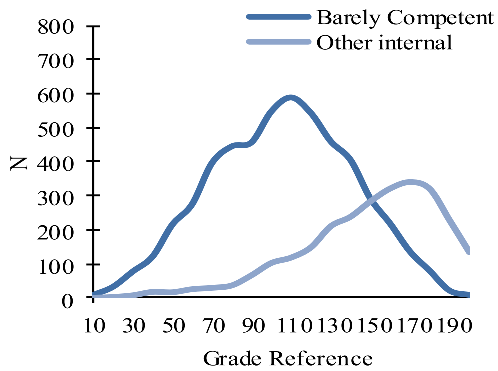


Figure 5.62. ENES Physics 2005 12th grade

CUT SCORE		CUT SCORE	
MCGM1	9.3	MCGM1	12.7
MCGM2	10.2	MCGM2	12.3

Comment: This was the final exam with code 115. The cut score remained negative, although there was improvement in the overall average grade of the exams. The cut score for internal examinees was between 12 and 13.

Figure 5.63 shows the cut score variation between MCGM1 and MCGM2.

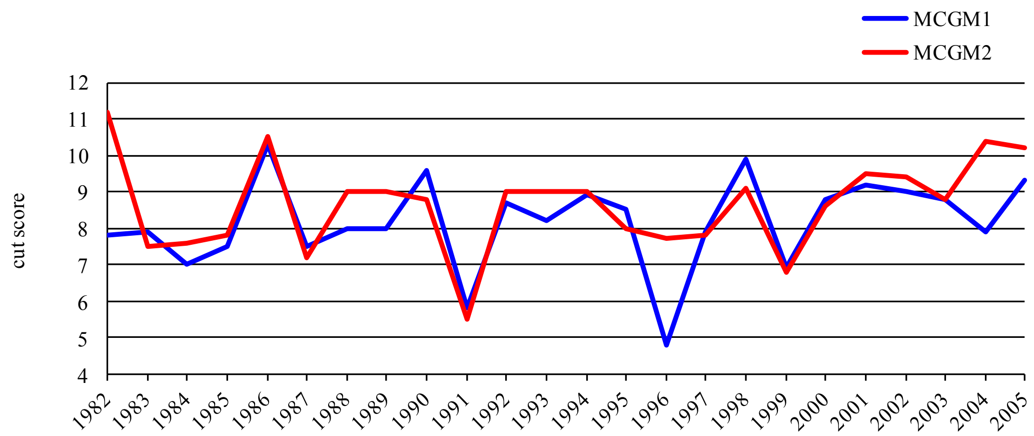


Figure 5.63. Cut scores obtained through MCGM1 and MCGM2 in the Physics exam, between 1982 and 2005.

Figure 5.63 reveals some discrepancies between the cut scores calculated through MCGM1 and MCGM2. These samples show less symmetry than the 2nd and 3rd cycles in the distribution of frequencies, leading to inversions of the cut scores obtained by MCGM1 and MCGM2. This is clearly seen in the beginning of the two changes in 1982 and 1996, where the exam grades achieved by external students were very low and internal students achieved high grades.

The data sampled from various public schools and from the statistics of the Ministry of Education point to a negative cut score in the Physics exams between 1982 and 2005, with the exception of 1982 and 1986. The cut scores for the 1991 and 1999 exams are very low, but the samples for those years are also very small.

Similarly to 1949 regarding the Physical-Chemical Sciences exam, the first exam following the creation of 12th grade, in 1982, had the best cut score of the 23 years of Physics exams.

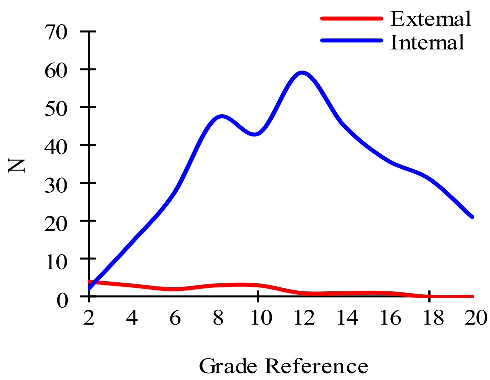


Figure 5.64. School 3 - Chemistry 1982 12th grade

CUT SCORE	
MCGM1	8.6
MCGM2	11.1
Linear Regression	9.9

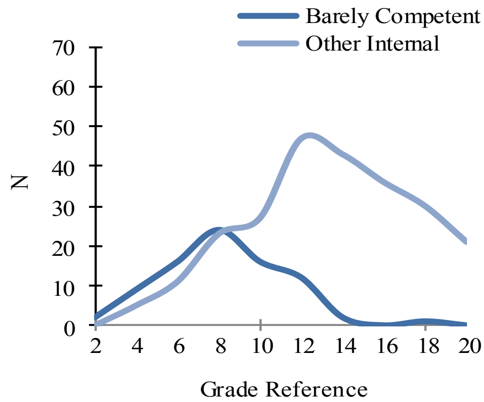


Figure 5.65. School 3 - Chemistry 1982 12th grade

CUT SCORE	
MCGM1	9.9
MCGM2	9.9

Comment: Contrary to what happened in the first Chemistry exam after the creation of 12th grade, the cut score is slightly negative, both for all the students and for the internal students in this sample.

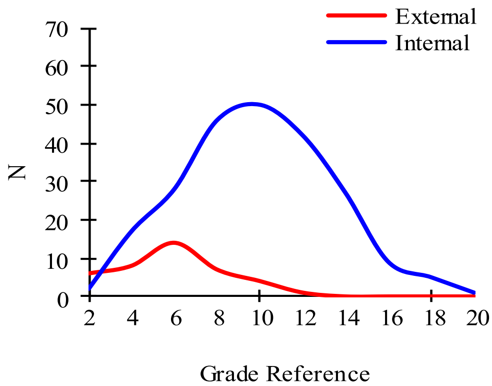


Figure 5.66. School 3 - Chemistry 1983 12th grade

CUT SCORE	
MCGM1	7.0
MCGM2	7.5

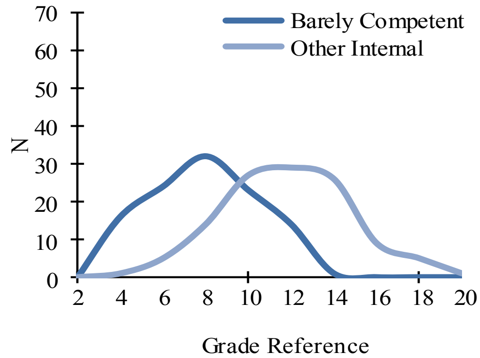


Figure 5.67. School 3 - Chemistry 1983 12th grade

CUT SCORE	
MCGM1	9.0
MCGM2	9.3

Comment: There was a decrease in the exam grades of internal students, especially of barely competent examinees which lead to a lowering of the cut score to similar levels of that of the Physics exam.

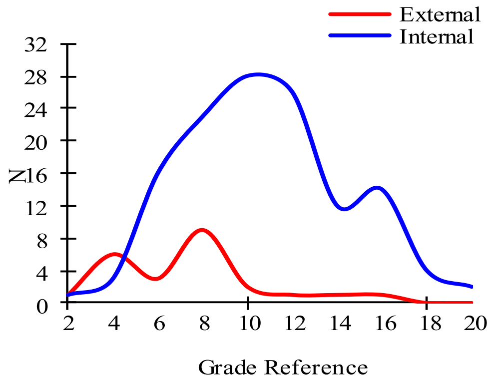


Figure 5.68. School 3 - Chemistry 1984 12th grade

CUT SCORE	
MCGM1	8.5
MCGM2	8.5

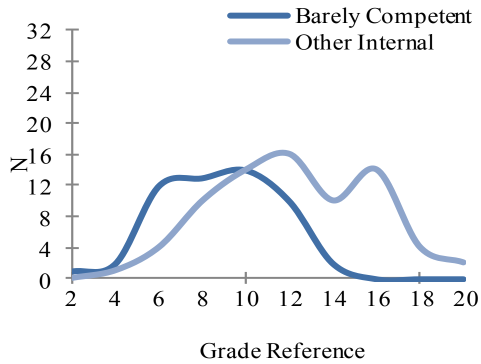


Figure 5.69. School 3 - Chemistry 1984 12th grade

CUT SCORE	
MCGM1	9.5
MCGM2	9.9

Comment: There is an improvement of the cut score for both internal students and all the examinees. The number of examinees was cut to approximately half as the 12th grade became available in other public schools.

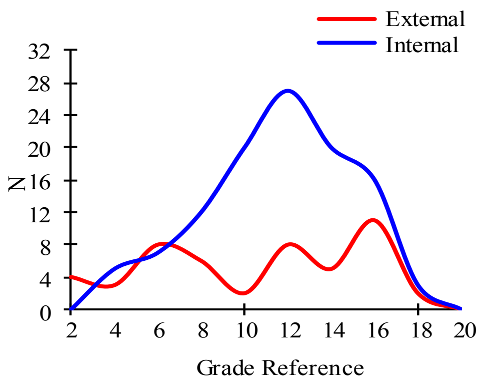


Figure 5.70. School 3 - Chemistry 1985 12th grade

CUT SCORE	
MCGM1	11.0
MCGM2	10.5

Comment: The cut score was positive. Many of the external examinees proposed themselves to exam to improve their grades.

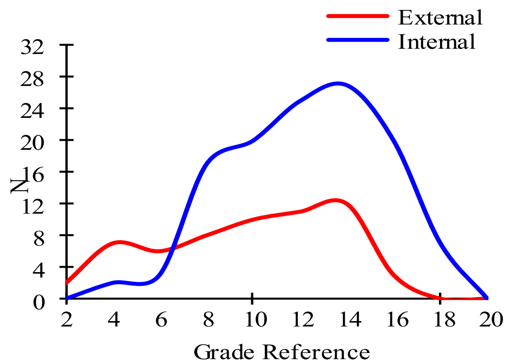


Figure 5.71. School 3 - Chemistry 1986 12th grade

CUT SCORE	
MCGM1	11.0
MCGM2	10.6
Linear Regression	11.2

Comment: The cut score remained positive, unlike what happened with the Physics exam.

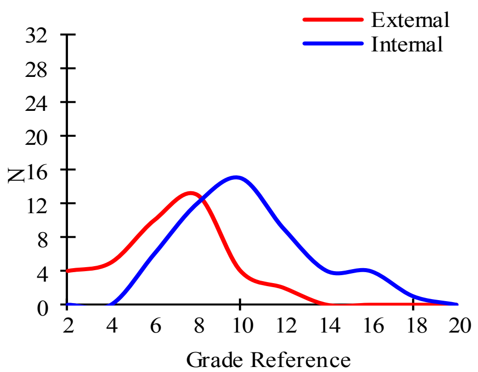


Figure 5.72. School 3 - Chemistry 1987 12th grade

CUT SCORE	
MCGM1	8.3
MCGM2	8.0
Linear Regression	6.7

Comment: The cut score went back to being negative in this school, in a small sample of students.

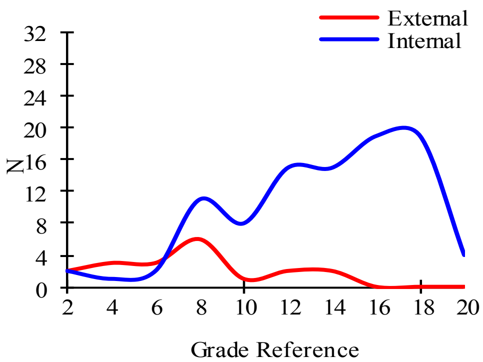


Figure 5.73. School 3 - Chemistry 1988 12th grade

CUT SCORE	
MCGM1	10.5
MCGM2	10.1

Comment: The examinees are mainly internal and the cut score is positive.

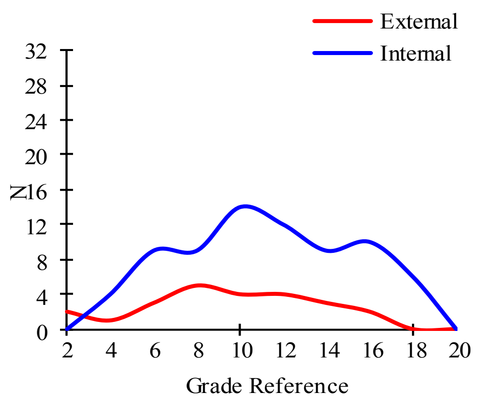


Figure 5.74. School 3 - Chemistry 1989 12th grade

CUT SCORE	
MCGM1	11.0
MCGM2	10.6
Linear Regression	11.2

Comment: There isn't a significant variation when compared with the previous year, with the exception of a lower number of maximum grades.

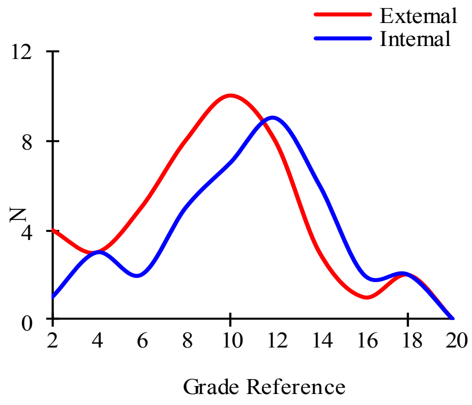


Figure 5.75. School 3 - Chemistry 1990 12th grade

CUT SCORE	
MCGM1	6.4
MCGM2	6.8

Comment: The cut score was lower since the number of examinees was lower and the external examinees out-numbered the internal.

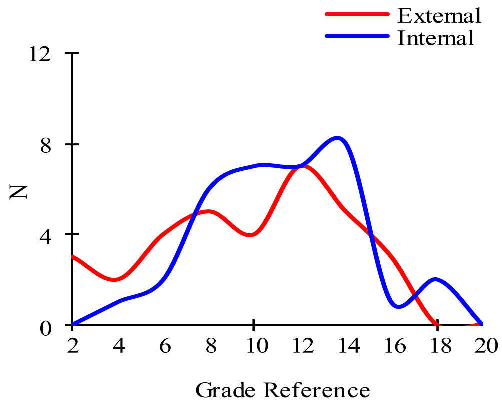


Figure 5.76. School 3 - Chemistry 1991 12th grade

CUT SCORE	
MCGM1	8.2
MCGM2	8.5

Comment: The number of examinees stayed low but an increase of internal examinees led to an increase of the cut score.

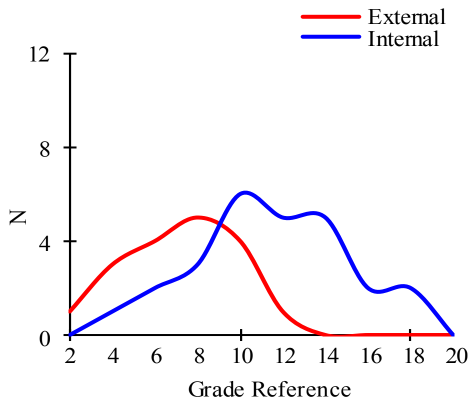


Figure 5.77. School 3 - Chemistry 1992 12th grade

CUT SCORE	
MCGM1	8.6
MCGM2	8.8

Comment: The cut score stayed negative in this small sample of examinees.

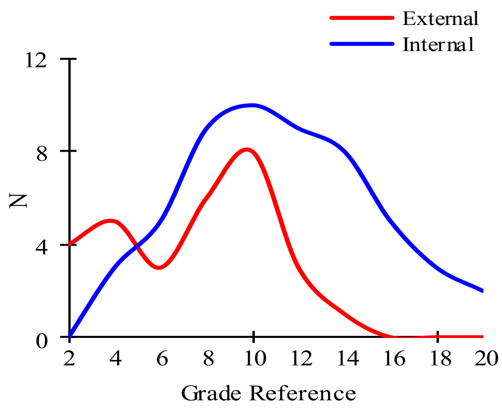


Figure 5.78. School 3 - Chemistry 1993 12th grade

CUT SCORE	
MCGM1	7.5
MCGM2	7.3

Comment: The number of examinees increased for both groups and the cut scored was lower.

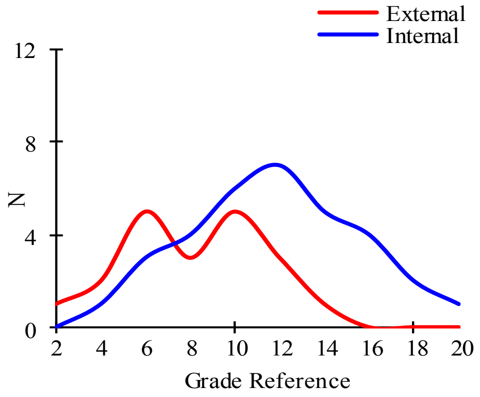


Figure 5.79. School 3 - Chemistry 1994 12th grade

CUT SCORE	
MCGM1	9.0
MCGM2	9.5

Comment: There are a high number of external examinees and the cut score decreases.

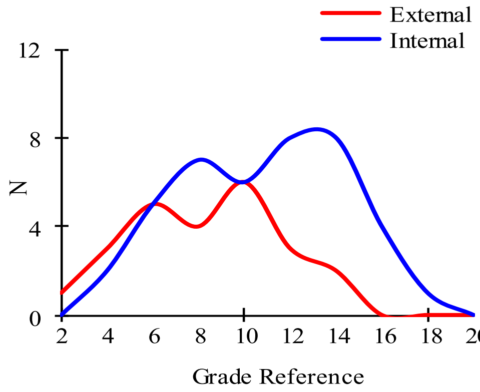


Figure 5.80. School 3 - Chemistry 1995 12th grade

CUT SCORE	
MCGM1	8.3
MCGM2	8.5

Comment: The cut score decreases with the higher number of examinees in both groups.

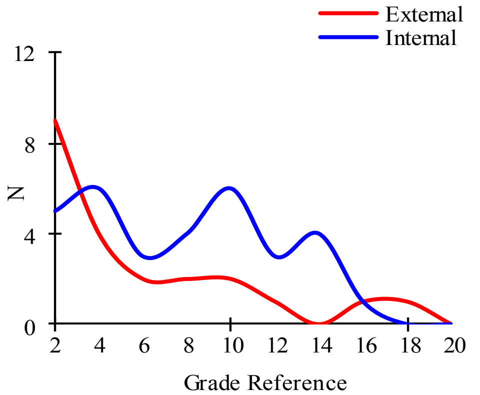


Figure 5.81. School 3 - Chemistry 1996 12th grade

CUT SCORE	
MCGM1	4.8
MCGM2	7.0
Linear Regression	5.0

Comment: This was the first Chemistry exam with code 142. As what happened with the Physics exam, the cut score was very low.

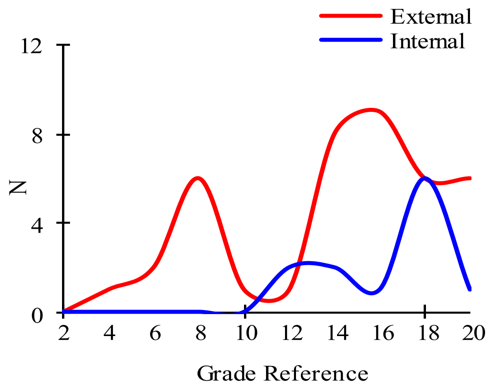


Figure 5.82. School 3 - Chemistry 1997 12th grade

CUT SCORE	
MCGM1	16.1
MCGM2	14.6

Comment: Unlike the Physics exam, the cut score became positive and stayed that way at the national level until 2005. Many of the external examinees were taking the exam to improve their grade.

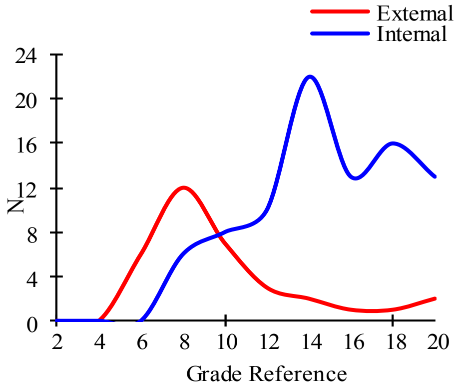


Figure 5.83. School 3 - Chemistry 1998 12th grade

CUT SCORE	
MCGM1	11.8
MCGM2	11.1
Linear Regression	7.5

Comment: The cut score was positive due to the grades of the internal students.

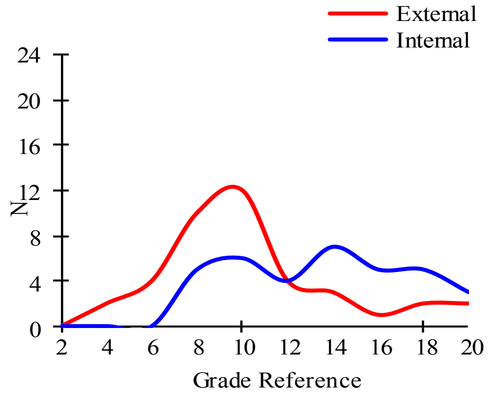


Figure 5.84. School 3 - Chemistry 1999 12th grade

CUT SCORE	
MCGM1	10.8
MCGM2	11.2

Comment: There was a significant reduction in the number of examinees due to the change of facilities of the school. The cut score stayed positive even though there were a high number of external examinees.

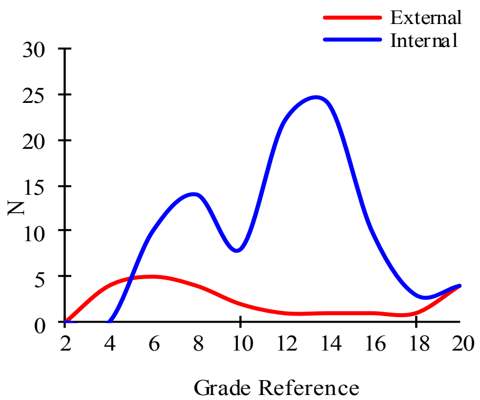


Figure 5.85. School 3 - Chemistry 2000 12th grade

CUT SCORE	
MCGM1	9.4
MCGM2	10.1
Linear Regression	7.8

Comment: The cut score was positive due to the grades of the internal students.

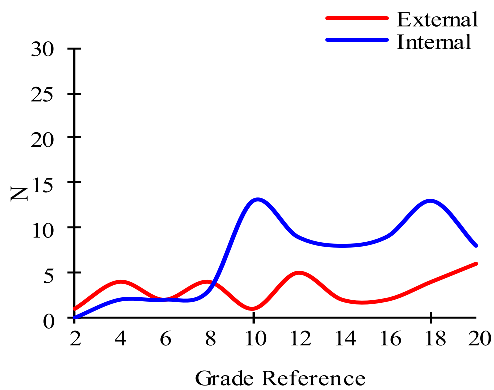


Figure 5.86. School 3 - Chemistry 2001 12th grade

CUT SCORE	
MCGM1	12.5
MCGM2	12.3
Linear Regression	6.7

Comment: Although there are a lower number of internal students, the cut score remained positive.

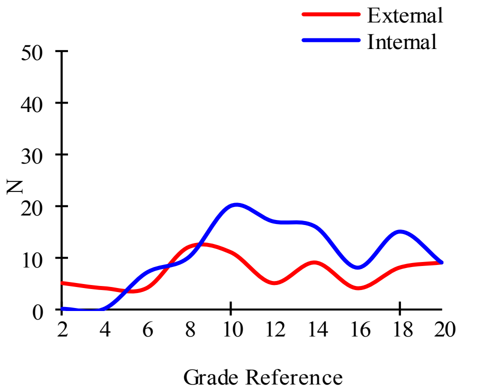


Figure 5.87. 6 schools -- Chemistry 2002 12th grade

CUT SCORE	
MCGM1	10.8
MCGM2	11.5

Comment: The sample was broadened to more schools due to the low number of examinees in school 3. The cut score stayed positive.

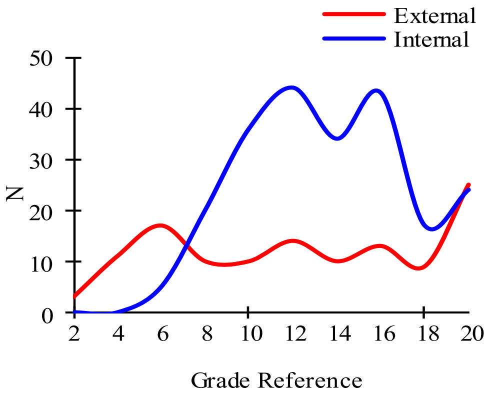


Figure 5.88. 9 schools -- Chemistry 2003 12th grade

CUT SCORE	
MCGM1	12.0
MCGM2	12.0
Linear Regression	14.0

Comment: As had happened in the previous year, there is an atypical behaviour from the external examinees. The grades of the internal students contributed to an increase of the cut score.

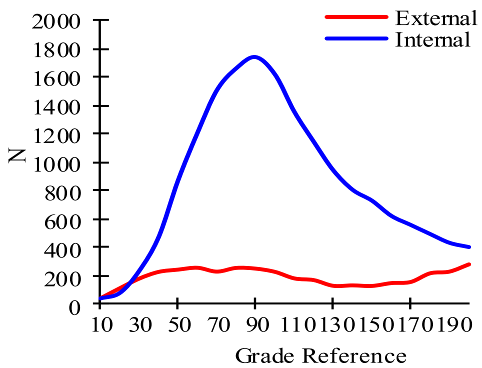


Figure 5.89. ENES Chemistry 2004 12th grade

CUT SCORE	
MCGM1	9.8
MCGM2	10.2

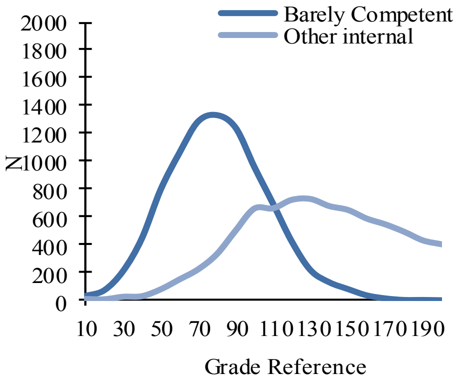


Figure 5.90. ENES Chemistry 2004 12th grade

CUT SCORE	
MCGM1	10.2
MCGM2	10.3

Comment: The cut score is positive when considering all the examinees that did this exam. According to the data available at ENES (Secondary School National Statistics) the average exam grade of the 16 920 internal students was, approximately 108 points (or 11)

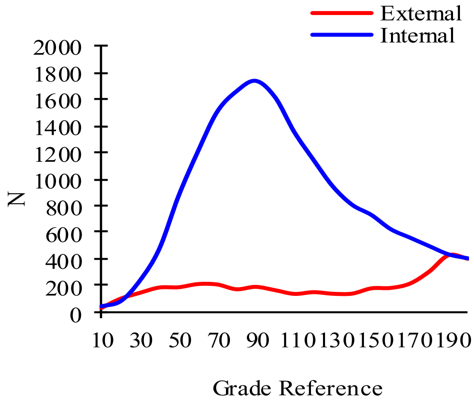


Figure 5.91. ENES Chemistry 2005 12th grade

CUT SCORE	
MCGM1	12.0
MCGM2	10.4
Linear Regression	15.8

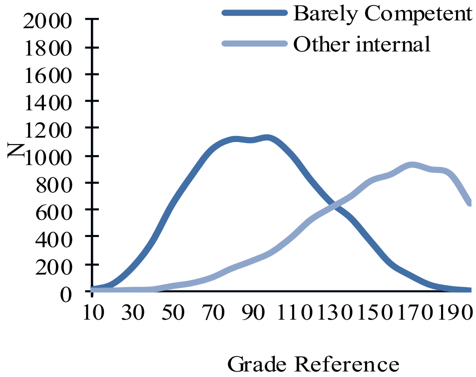


Figure 5.92. ENES Chemistry 2005 12th grade

CUT SCORE	
MCGM1	12.1
MCGM2	11.9
Linear Regression	16.4

Comment: The cut score stayed positive and even showed a slight improvement for all the examinees and both groups of internal students.

Figure 5.93 shows the cut score variation between MCGM1 and MCGM2.

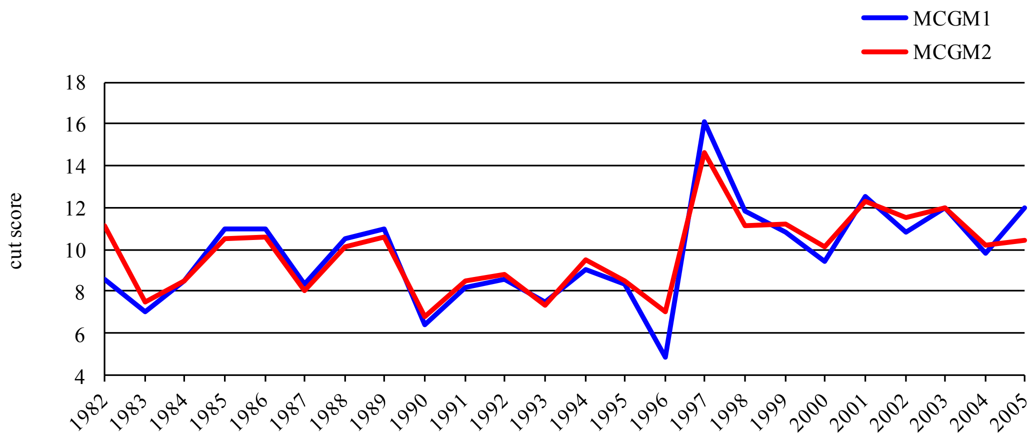


Figure 5.93. Cut scores obtained through MCGM1 and MCGM2, in the Chemistry exam, between 1982 and 2005.

Unlike what happened with the Physics exam, the cut score for the Chemistry exam was positive in the majority of the 23 years it happened. On the other hand, figure 5.93 does not show big discrepancies between the cut scores obtained through MCGM1 and MCGM2. These samples show more symmetry than the ones from the Physics exam. Similarly to the Physics exam, there is an inversion of cut score values in 1982 and 1996, when the exam grades of external students were very low and internal students had high grades. The atypical behaviour from external students is due to a lot of exam applications to improve grades, as students need high grades to be accepted in healthcare degrees.

Another point that should be highlighted is the variation of the cut scores calculated using linear regression. The goal was to determine if there was a linear relationship between exam grades and the groups of internal and external students. This type of analysis is known Potthoff (1966) analysis and it can be used to predict how test validity varies across different groups of students. Similarly to what happened with Poteat, Wuensch, and Gregg's (1988) research, the results do not allow us to define a clear distinction between internal and external students for all the exams.

5.2 Beuk Method

The results for each question (QA and QB), total average, standard deviation, ratio of these standard deviations (stdQA/stdQB) and slope of a line equal to this ratio are presented in Appendix 2:

Group I – Physics-Chemistry exams of 1956, 1960, 1965, 1969 and 1972 – *Table 6.22*;
Group II – Physics and Chemistry exams of 1982, 1983 and 1984 – *Tables 6.23* to *6.24*;
Group III – Physics and Chemistry exams of 2004 and 2005 – *Tables 6.25* to *6.26*.

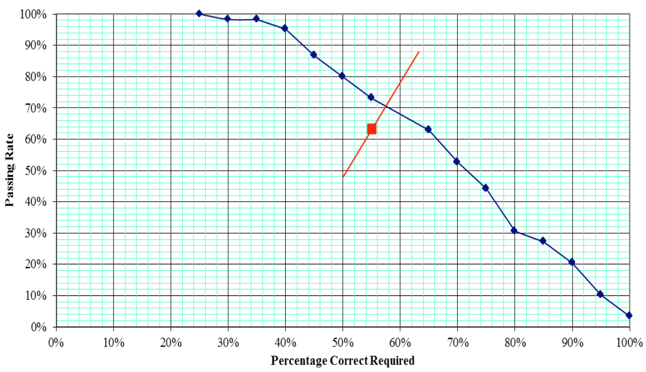
The Beuk method is a special case of the Hofstee procedure and rests on two assumptions. According to Beuk, first, it must be assumed that each teacher "has an opinion of which passing score should be required, and what pass rate can be expected." (Beuk, 1984, p. 148) Second, Beuk alleged that "the relative emphasis given to the two types of judgments should be in proportion to the extent to which teachers agree with each other." (Beuk, 1984, p. 148) The ten chosen teachers are very experienced and got feedback on their answers given.

The students' results for two High Schools are shown in Appendix 3:

Group I – *Tables 6.27* to *6.32*;
Group II – *Tables 6.32* to *6.34* and *Tables 6.37* to *6.39*;
Group III – *Tables 6.35* to *6.36* and *Tables 6.40* to *6.41*.

In these tables SN is the student's number; IFG the Internal Final Grade – from examinees who are expected to pass the examination; EG is the Exam Grade – representing the cut scores and PR is the passing rate.

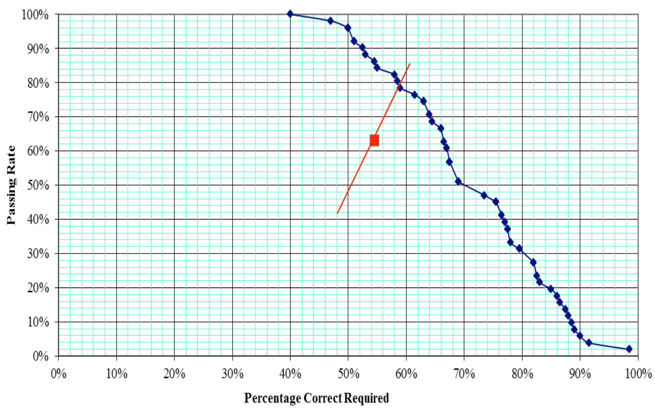
In order to apply Beuk's method the judgments of these ten teachers were compared with the students' results, like in another study (Silva, 2008b). The test scores (EG) and passing rate values (PR) of the Appendix 2 tables were plotted and the line obtained shows that the passing rate values increase while the exam score values decrease as expected. In each graphic the red dot represents the values obtained on teachers' judgment. The red line starting at the red dot was built with exam's slope and intersects the distributional curve.



slope: 1.6
intersection coordinates: (58%; 70%)
cut score or percentage correct: 58%
passing rate: 70%

Figure 5.94. Beuk cut score for the1956 Physics-Chemistry exam.

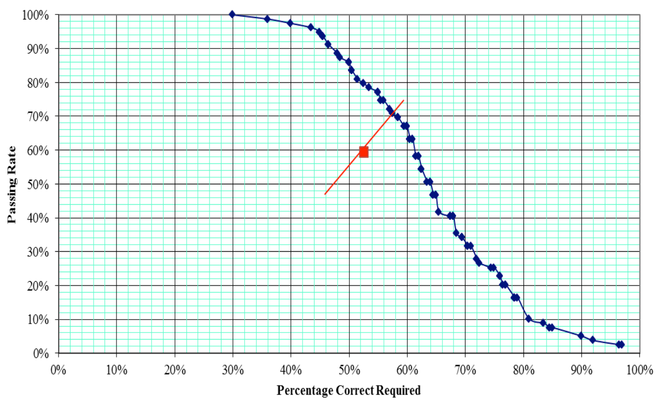
Comment: The test scores (EG) were medium and the minimum EG score was 25%. One of the explanations is that the students had IFG scores between than 50% and 75%. Other reasons were the existence of laboratory and oral exams besides the written exam. The average grade of the three exams plus the IFG grade allowed 51 of these 60 students to conclude the secondary Physics-Chemistry curricula. In the Contrasting Groups Method the cut score is 50% in both methods used.



slope: 2.0
intersection coordinates: (58%; 78%)
cut score or percentage correct: 58%
passing rate: 78%

Figure 5.95. Beuk cut score for the 1960 Physics-Chemistry exam.

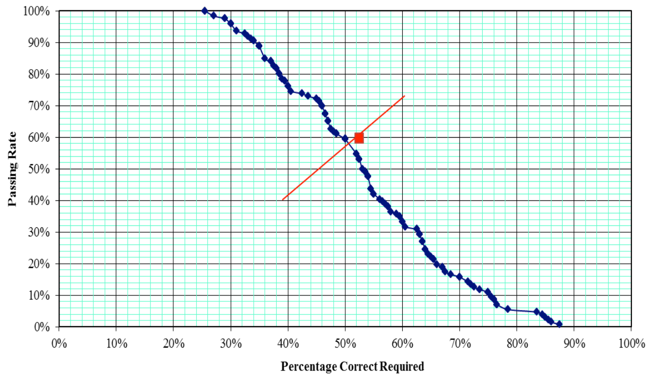
Comment: The test scores (EG) were high and the minimum EG score was 40%. One of the explanations is that the exam content and structure became well known. Data about the average grades of the three exams were not available. In the Contrasting Groups Method the cut score is 62% (MCGM1) and 66% (MCGM2).



slope: 1.0
intersection coordinates: (58%; 70%)
cut score or percentage correct: 58%
passing rate: 70%

Figure 5.96. Beuk cut score of the 1965 Physics-Chemistry exam.

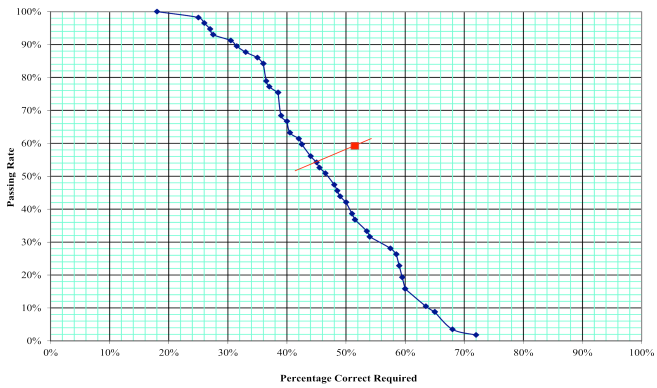
Comment: The Test scores (EG) were average and the minimum EG score was 30%. Data about the average grades of the three exams was not available. In the Contrasting Groups Method the cut score is 57% (MCGM1) and 60% (MCGM2).



slope: 0.8
intersection coordinates: (50%; 58%)
cut score or percentage correct: 50%
passing rate: 58%

Figure 5.97. Beuk cut score for the 1969 Physics-Chemistry exam.

Comment: The test scores (EG) were average and the minimum EG score was 25%. One of the explanations is that students with IFG scores higher than 70% were exempted from this exam. Data about the average grades of the three exams was not available. In the Contrasting Groups Method the cut score is 57% (MCGM1 and MCGM2).

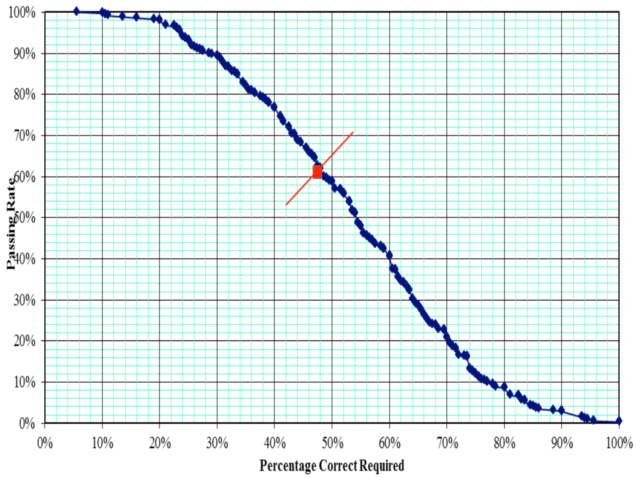


slope: 0.5
intersection coordinates: (45%; 53%)
cut score or percentage correct: 45%
passing rate: 53%

Figure 5.98. Beuk cut score for the 1972 Physics-Chemistry exam

Comment: The test scores (EG) were low and the minimum EG score was 19%. The average grades of the three exams plus IFG grades allowed for 53 of these 56 students to conclude the secondary Physics-Chemistry curricula. In the Contrasting Groups Method the cut score is 41% (MCGM1 and MCGM2).

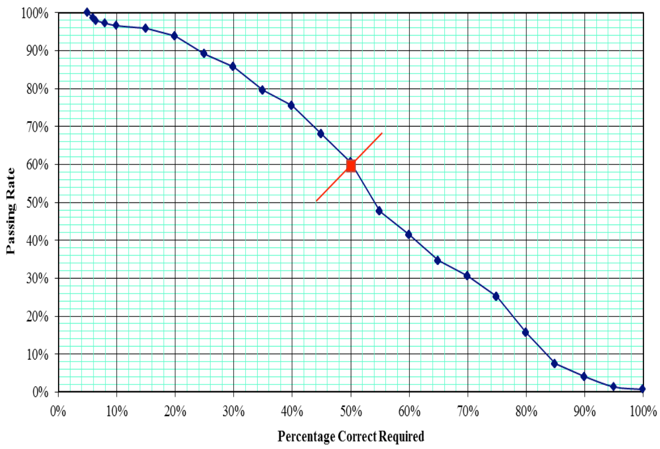
An identical analysis was made for the exams of Group II.



slope: 0.8
intersection coordinates: (48%; 60%)
cut score or percentage correct: 48%
passing rate: 60%

Figure 5.99. Beuk cut score for the 1982 Physics exam.

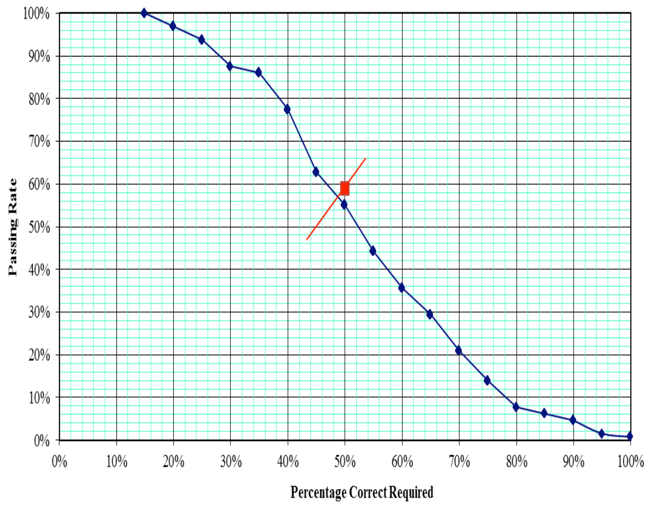
Comment: The test scores (EG) were low and the minimum EG score was 6%. Students had IFG scores between 50% and 95%. The average grades for the three exams plus IFG grades allowed for 236 of these 311 students to conclude the secondary Physics curriculum. In the Contrasting Groups Method the cut score is 52% (MCGM1 and MCGM2).



slope: 0.8
intersection coordinates: (50%; 60%)
cut score or percentage correct: 50%
passing rate: 60%

Figure 5.100. Beuk cut score for the 1983 Physics exam.

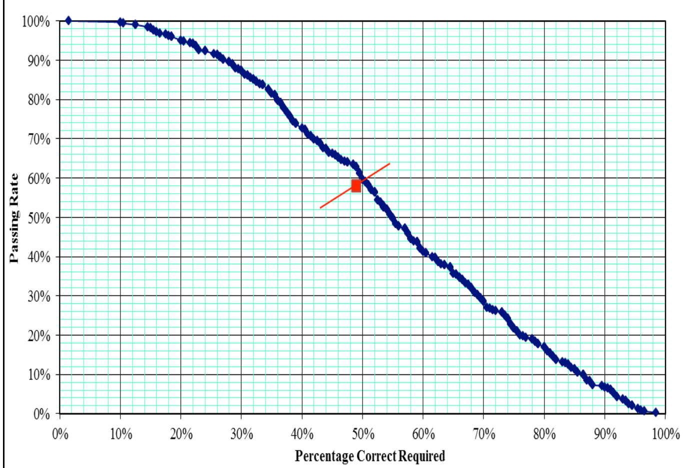
Comment: The test scores (EG) were average and the minimum EG score was 7%. Students had IFG scores between 50% and 95%. The average grades of the three exams plus IFG grades allowed for 112 of these 147 students to conclude the secondary Physics curriculum. In the Contrasting Groups Method the cut score is 53% (MCGM1) and 52% (MCGM2).



slope: 0.8
intersection coordinates: (48%; 58%)
cut score or percentage correct: 48%
passing rate: 58%

Figure 5.101. Beuk cut score for the 1984 Physics exam.

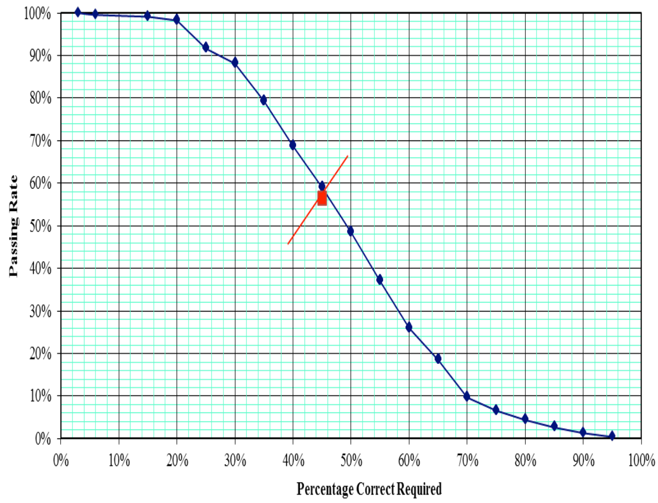
Comment: The test scores (EG) were low and the minimum EG score was 15%. Students had IFG scores between 50% and 100 %. The average grades of the three exams plus IFG grades allowed for 100 of these 129 students to conclude the secondary Physics curriculum. In the Contrasting Groups Method the cut score is 50% (MCGM1) and 48% (MCGM2).



slope: 0.5
intersection coordinates: (50%; 60%)
cut score or percentage correct: 50%
passing rate: 60%

Figure 5.102. Beuk cut score for the 1982 Chemistry exam.

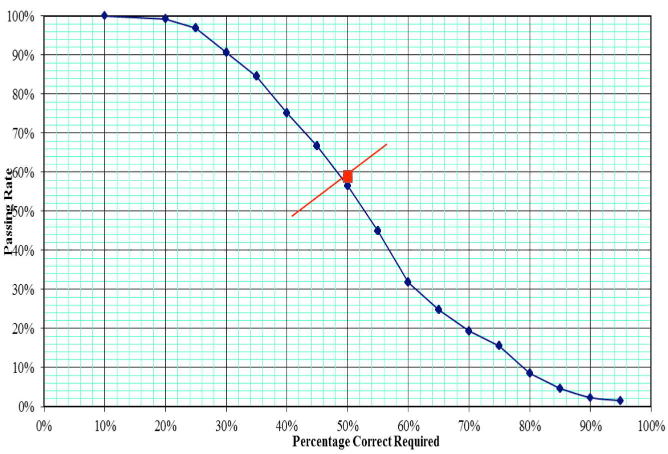
Comment: The test scores (EG) were average and the minimum EG score was 2%. Students had IFG scores between 50% and 100 %. The average grades of the exam plus IFG grades allowed for 204 of these 325 students to conclude the secondary Chemistry curriculum. In the Contrasting Groups Method the cut score is 50% for both the MCGM1 and MCGM2 methods.



slope: 1.1
intersection coordinates: (46%; 58%)
cut score or percentage correct: 46%
passing rate: 58%

Figure 5.103. Beuk cut score for the 1983 Chemistry exam.

Comment: The test scores (EG) were low and the minimum EG score was 3%. Students had IFG scores between 50% and 95 %. The average grades of the exam plus IFG grades allowed for 109 of these 227 students to conclude the secondary Chemistry curriculum. In the Contrasting Groups Method the cut score is 45% (MCGM1) and 47% (MCGM2).

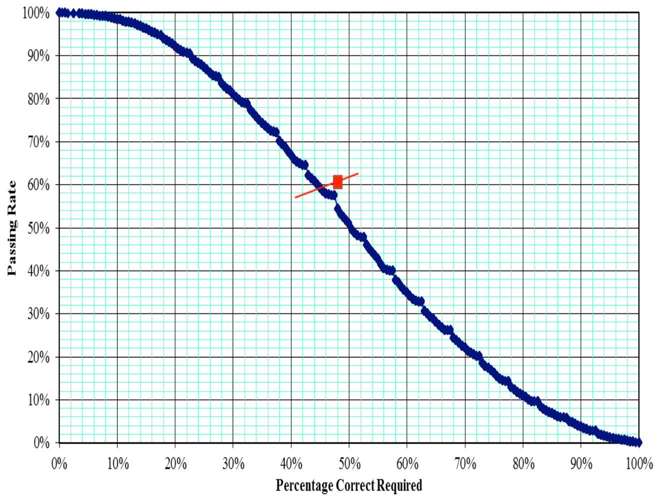


slope: 0.7
intersection coordinates: (49%; 58%)
cut score or percentage correct: 49%
passing rate: 58%

Figure 5.104. Beuk cut score of 1984 Chemistry exam.

Comment: The test scores (EG) were low and the minimum EG score was10%. Students had IFG scores between 50% and 95 %. The average grades of the exam plus IFG grades allowed for 86 of these 129 students to conclude the secondary Chemistry curriculum. In the Contrasting Groups Method the cut score is 48% (MCGM1) and 50% (MCGM2).

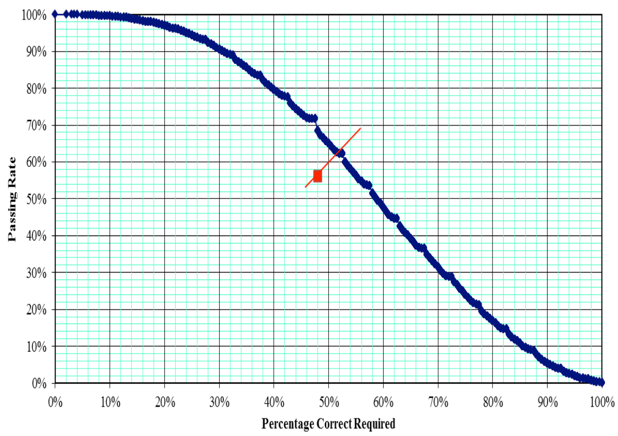
Below identical analysis for the exams of Group III are shown.



slope: 0.3
intersection coordinates: (46%; 59%)
cut score or percentage correct: 46%
passing rate: 59%

Figure 5.105. Beuk cut score for the 2004 Physics exam.

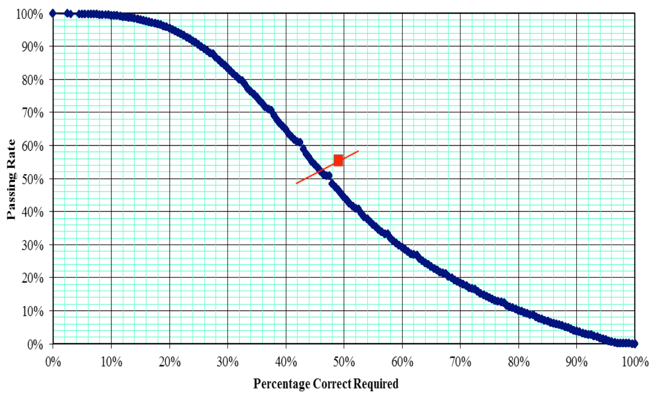
Comment: The test scores (EG) were low and the minimum EG score was 0%. The average grade of the exam plus IFG grades allowed for 6,492 (74%) of these 8,683 students to conclude the secondary Physics curriculum. In the Contrasting Groups Method the cut score is 59% (MCGM1) and 57% (MCGM2).



slope: 0.9
intersection coordinates: (52%; 62%)
cut score or percentage correct: 52%
passing rate: 62%

Figure 5.106. Beuk cut score for the 2005 Physics exam.

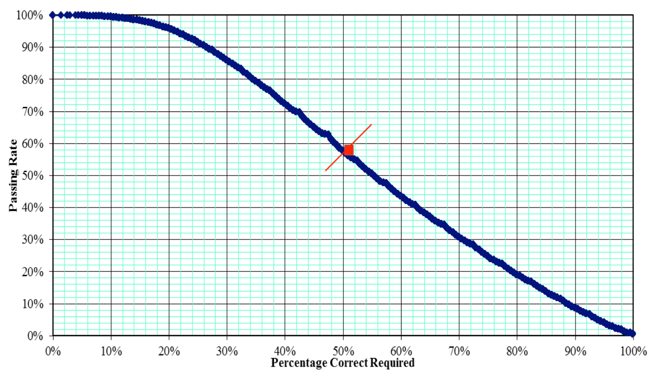
Comment: The test scores (EG) were average and the minimum EG score was 0%. The average grades of the exam plus IFG grades allowed for 6,618 (89%) of these 7,436 students to conclude the secondary Physics curriculum. In the Contrasting Groups Method the cut score is 64% (MCGM1) and 62% (MCGM2).



slope: 0.7
intersection coordinates: (46%; 52%)
cut score or percentage correct: 46%
passing rate: 52%

Figure 5.107. Beuk cut score for the 2004 Chemistry exam

Comment: The test scores (EG) were low and the minimum EG score was 0%, Students had IFG scores between 50% and 95%. The average grades of the exam plus IFG grades allowed 13,765 (81%) of these 16,920 students to conclude the secondary Chemistry curriculum. In the Contrasting Groups Method the cut score is 51% (MCGM1) and 52% (MCGM2).



slope: 1.1
intersection coordinates: (51%; 59%)
cut score or percentage correct: 51%
passing rate: 59%

Figure 5.108. Beuk cut score for the 2005 Chemistry exam.

Comment: The test scores (EG) were average and the minimum EG score was 0%. Students had IFG scores between 50% and 95%. The average grades of the exam plus IFG grades allowed for 16,625 (75%) of these 22,190 students to conclude the secondary Chemistry curriculum. In the Contrasting Groups Method the cut score is 61% (MCGM1) and 60% (MCGM2).

Group I shows generally lower test scores (EG), especially in the beginning of the curricular Reform, partially due to the relative consolidation of a set of procedures that include everything from the conception and writing of the exams and their distribution to the control and security mechanisms of the process. Another no less important issue is the "test correction process as its effects can lead to questions of fairness and justness of the process”. (Conceição, Neves, Campos, Fernandes, & Alaiz, 1994; Fernandes, 2004, p. 50)

In Group II around 1/4 to 1/3 of the students did not complete the secondary curriculum. These students had IFG grades above 50% but around half had exam grades under 50% showing how the continuous grading and the external grading were out of phase.

According to a study by Martinho (Martinho, 2009, p. 152), “there is no standard behaviour in group III for the Physics exams between 2000 and 2005, unlike in the Chemistry exams where 50% of students achieves an exam grade between 50% and 65%”.

Comparing the cut score results of the Beuk method with the results obtained with the Contrasting Groups Method for Group I (figure 5.109), we see that the values are lower in the Beuk method for the years 1956 and 1972.

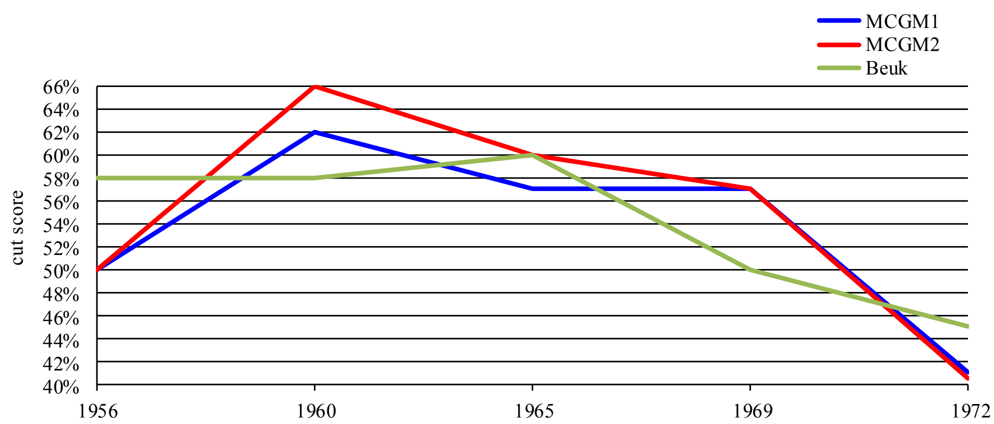


Figure 5.109. Cut score results of the Contrasting Method (MCGM1 e MCGM2) and Beuk method of Physics-Chemistry exams, for Group I.

They are the same in 1965, and in 1960 and 1969 the cut score obtained by either MCGM1 or MCGM2 are higher than the one from the Beuk Method. Performing the same comparison in Group II we can see a coincidence or acceptable approximation both in Physics and Chemistry (figure 5.110).

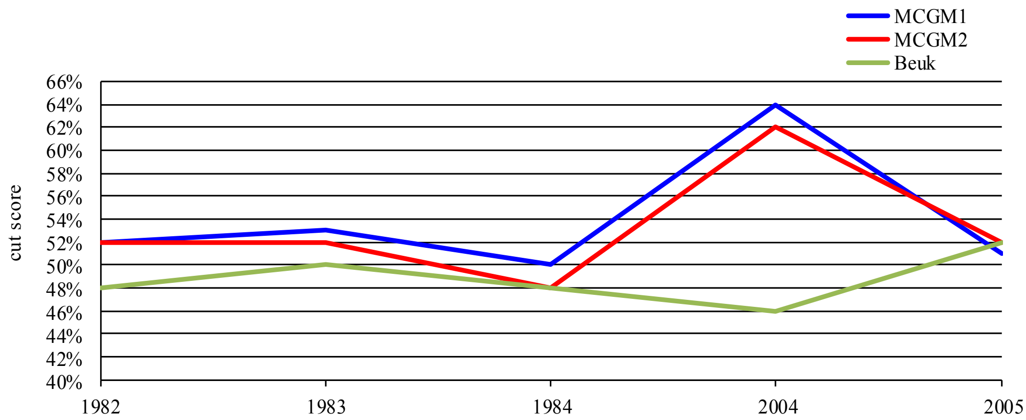


Figure 5.110. Cut score results of the Contrasting Method (MCGM1 e MCGM2) and Beuk method of Physics exams, for Group II and Group III.

In Group III (figure 5.110 and figure 5.111) there is a considerable difference in 2004 (about 10%) between the cut scores obtained by both methods, leading to the conclusion that the sample size and the distribution of ratings by Grade Reference cannot be ignored.

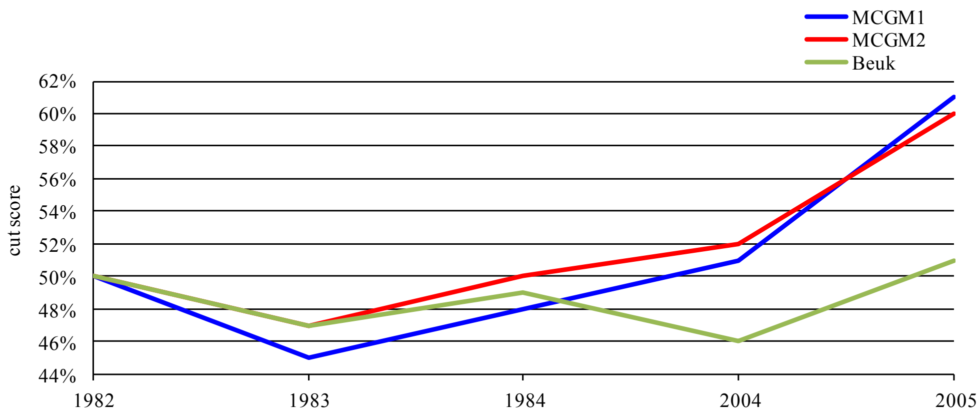


Figure 5.111. Cut score results of the Contrasting Method (MCGM1 e MCGM2) and Beuk method of Chemistry exams, for Group II and Group III.

One of this method's limitations is due to the fact that the computation work to obtain cut scores is approximate or visually estimated, introducing a source of potential error. As Cizeck (Beuk, 1984) noted the Beuk method can be described as a "compromise method" between relative and absolute performance standards.

5.3 Extended Angoff Method

An advantage of the Extended Angoff Method when compared to the Contrasting Groups Method is that it evaluates, on an item-by-item basis, the performance of the group of examinees.

Physics Exam 1st Phase, 1st call, 2003 (see tables 6.42 to 6.44)

Figure 5.112 provides the overall score distribution achieved by both Group B1 and Group B2.

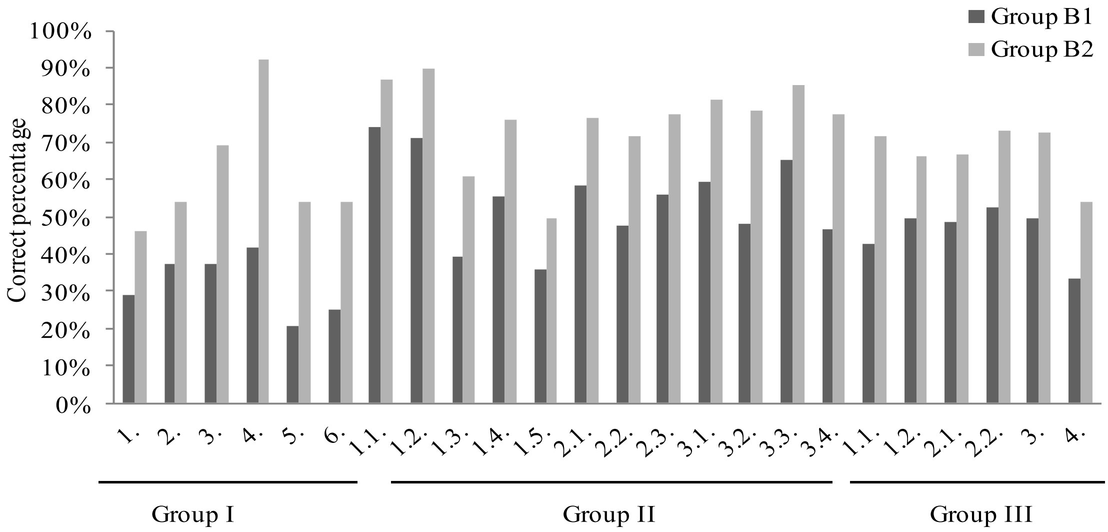


Figure 5.112 A bar chart of the percentage of correct item answers for Groups B1 and Group B2.

In all the items of this sample the average performance level of Group B1 is lower than the average performance level of Group B2. For the Angoff Method, the grades achieved by the examinees in each item for each exam were treated to allow a later comparison with the graders estimates for the Angoff Method. For the six multiple-choice items the grade considered was 0 for a wrong answer and 1, instead of 10 points, for the right answer. The grades of the remaining items, with written answers, were transposed to a scale from 1 to 4. This treatment led to scale adapted to each exam were the results of the Group I items were transposed to a 0-1 scale and the Group II and III items were transposed to a 1-4 scale. There was concordance between the newly built scales and the 0 to 200 points scale.

Table 5.1 shows the average grades of the items achieved by Group B1 and the estimates of the grading teachers (G.T.) on the transposed scale of 18 to 78 points.

Table 5.1. Table of the average grades per item (Group B1 and Grading Teachers Group) in the 18 to 78 points scale.

Physics Exam 1st Phase, 1st call, 2003																								
	Group I						Group II												Group III					
	1	2	3	4	5	6	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	3.1	3.2	3.3	3.4	1.1	1.2	2.1	2.2	3	4
B1	0.3	0.4	0.4	0.4	0.2	0.3	3.0	2.8	1.6	2.2	1.4	2.3	1.9	2.2	2.4	1.9	2.6	1.9	1.7	2.0	2.0	2.1	2.0	1.3
G.T.	0.5	0.5	0.7	0.9	0.5	0.5	2.6	3.2	1.8	2.4	2.2	2.8	2.4	2.2	3.4	2.8	3.0	2.4	2.3	2.4	2.3	2.5	2.4	2.6

In this process we saw that only in item 1.3 the expectations of getting a right answer were lower than 50%. On the other hand, the estimates of the teachers were higher than the grades achieved by the examinees, with one exception: the items 1.1 from Group II. One possible explanation for the fact that the average achieved by the examinees in item 1.1 was higher than what was expected by the teachers is related to routine application of the two parametric equations of kinematics required to solve the item. The average grade of the examinees from Group B1 in item 2.3 was the only one that matched the expectations of the grading teachers.

Considering the average grades of Group B1 (39 points) and of the Group of Grading Teachers (48 points), its weighted average is 44 points, or 68 points on the 0 to 200 points scale. This value is lower than the average exam grade for Group B1 (71 points), despite the teachers expectations.

Logistic regression uses, by default, the lowest of the two distributions (designated by 0 – belonging to Group B1) as the reference distribution in order to estimate the highest (designated by 1 – belonging to Group B2 or to the Group of Grading Teachers). For both regressions the grades were entered in a single step avoiding any variation between, step, block, and model.

As was similarly done in other studies (Silva, 2009a; 2009b, p. 7; V. Teodoro & Silva, 2010), the cut score was determined by applying the following equation:

$$y = a + b\,(x),$$

where y is the probable value of the variable that defines the examinee as belonging to a group, a is the constant, b the slope of the regression function, and x is the observed value of the grade of the examinee.

In the typical context of a regression the objective is to determine the value of y, associated to a known value of x, by substitution in the equation. (Cizek and Bunch, 2007) In this case the goal is to find the values of x, attached to results located between the distributions of Group B1 and Group B2, and the distributions of Group B1 and the Group of Grading Teachers. Since both distributions are coded as 0 and 1, respectively, we used a value of y = 0.56 in the linear regressions of Groups B1 and B2 of internal examinees, and of Groups B1 and Grading Teachers. The choice of this value meant considering the relative percentages of belonging to a group.

The values of the constant *a* and of the slope *b* of the linear regression function, were determined resorting to the SPSS software, and they allowed the cut scores determination:

a) Of the total sample, considering the exam grades of all the sample elements (Group B1 + Group B2) in the 0 to 200 points scale;

b) Of the ensemble (Group B1 + Grading Teachers) in the 18 to 78 transformed scale.

The summary of the results is presented in Table 5.2.

Table 5.2. Results of the binomial logistic regression.

	constant (a)	slope (b)	*cut score*
Group B1+ Group B2	- 5.466	0.053	113 points
Group B1 + Grading Teachers	-5.552	0.091	70 points

The value of the cut score for the ensemble Group B1 + Grading Teachers, 70, or 137 in the 0 to 200 points scale, was the expected value when faced with the high average item grades estimated by the grading teachers.

The same software was applied in the analysis of the item answers for the examinees of Groups B1 and B2, and the examinees of Group B1 and the Grading Teachers.

The results of this analysis to the item answers are shown in table 5.3.

Table 5.3. Item answer analysis results.

	constant (a)	slope (b)	*cut score*
Group B1+ Group B2	- 6.978	0.067	62 points
Group B1 + Grading Teachers	- 6.241	0.098	69 points

The cut scores of the ensembles are for Group B1 + Group B2, 62, the equivalent to 112 points, and for Group B1 + Grading Teachers, 69, the equivalent to 131 points, in the 0 to 200 points scale. Comparing the results from both linear regressions the biggest discrepancy is 3%, despite the size of the sample.

Physics Exam 1st Phase, 2004 (see tables 6.45 to 6.47)

Figure 5.113 provides the overall score distribution achieved by both Group B1 and Group B2 in this exam.

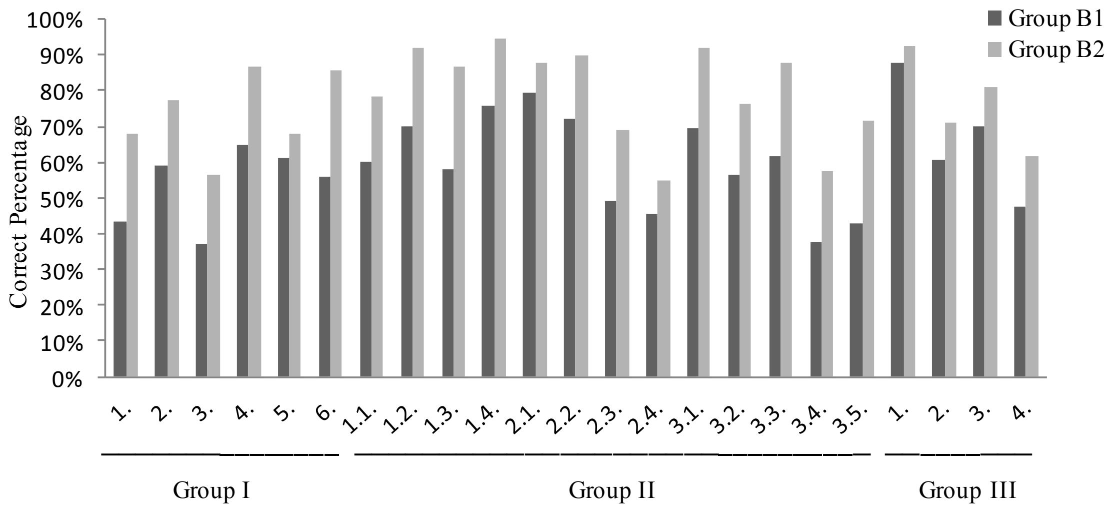


Figure 5.113. A bar chart of the percentage of correct item answers for Group B1 and Group B2.

In all the items of this sample the average performance level of Group B1 is lower than the performance level of Group B2. Once again the transposition to an adapted scale was done following the procedure previously described.

Table 5.4 shows the average grades of the items achieved by Group B1 and the estimates of the grading teachers (G.T.) on the transposed scale of 17 to 74 points.

Table 5.4. Table of the average grades per item in the 17 to 74 points scale.

Physics Exam 1st Phase, 2004																							
	Group I						Group II													Group III			
	1	2	3	4	5	6	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	1	2	3	4
B1	0.4	0.6	0.4	0.7	0.6	0.6	2.4	2.8	2.3	3.0	3.2	2.9	2.0	1.8	2.8	2.3	2.5	1.5	1.7	3.5	2.4	2.8	1.9
G.T.	0.5	0.4	0.5	0.7	0.7	0.5	2.6	2.9	2.4	3.1	3.2	2.9	2.2	2.1	2.9	2.3	2.6	2.9	2.0	3.4	2.4	2.9	2.1

In this process the average item grades of the grading teachers were considered and only item 2 (Group I) had an expectation of getting a right answer lower than 50%. On the other hand, the teachers' estimates were higher than the grades achieved by the examinees, with one exception: items 2 and 6 of Group I. A possible explanation for the fact that the average grade achieved by the examinees in item 2 is higher than expected is the extensive study of projectile launch, in item 6 with the presentation of a well-known expression for acceleration in uniform circular motion. There is a higher convergence between the examinees' average grade in several items and the expectations of the grading teachers.

Considering the average grades of Group B1 (45 points) and of the Group of Grading Teachers (47 points), the weighted average is 46 points, or 78 points in the 0 to 200 points scale. This value is lower than the average exam grade for Group B1 (102 points), although the expectations of the grading teachers are close to this value.

In order to calculate the cut scores considering the average grades, the constant and slope values of the linear regression function had to be calculated, using the 0 to 200 points scale for Group B1 + Group B2 and using the 17 to 74 points transformed scale for the ensemble (Group B1 + Grading Teachers).

The results are shown in Table 5.5.

Table 5.5. Results of the binomial logistic regression.

	constant (a)	slope (b)	*cut score*
Group B1+ Group B2	- 5.237	0.051	115 points
Group B1 + Grading Teachers	- 5.663	0.096	65 points

The value of the cut score for the ensemble Group B1 + Grading Teachers is 65, the equivalent of 131 points in the 0 to 200 points scale, and its was the expected value knowing the high average grade of the items estimated by the grading teachers.

The same software used previously was applied to the analysis of the item answers, both to the examinees of Groups B1 and B2 and the examinees of Group B1 and the Grading Teachers.

The results of this analysis to the item answers are shown in table 5.6.

Table 5.6. Item answer analysis results for internal examinees and for the ensemble Group B1 + Grading Teachers.

	constant (a)	slope (b)	*cut score*
Group B1+ Group B2	- 5.732	0.103	61 points
Group B1 + Grading Teachers	- 5.943	0.096	66 points

The cut score values for the ensembles are: Group B1 + Group B2, 61 points, equivalent to 118 points, Group B1 + Grading Teachers, 66, equivalent to 136 points in the 0 to 200 points scale. A 2.5% variation can be observed when comparing the cut scores from table 5.5 and table 5.6.

Keeping in mind the descriptive analysis of the two separate groups, in the sample and in the ENES (Secondary School National Statistics), shown in figure 5.114, we can highlight the low range of the sample, consisting only of examinees from schools in the Greater Lisbon area, with higher results than the national average.

	Group B1		Group B2	
	sample	*ENES*	*sample*	*ENES*
Range	154	5216	97	2794
Mean	101	90	147	138
Maximum	162	195	197	200
Minimum	9	0	57	2
Median	102	91	156	144
Standard Deviation	33.4	35.2	31.4	35.1
Standard Error	2.65	0.48	3.19	0.66

Figure 5.114. Descriptive analysis of Group B1 and Group B2 (sample and ENES), in 2004 Physics exam.

Physics Exam 1st Phase, 2005 (see tables 6.45 to 6.47)

Figure 5.115 provides the overall score distribution achieved by both Group B1 and Group B2 in the 2005 Physics Exam.

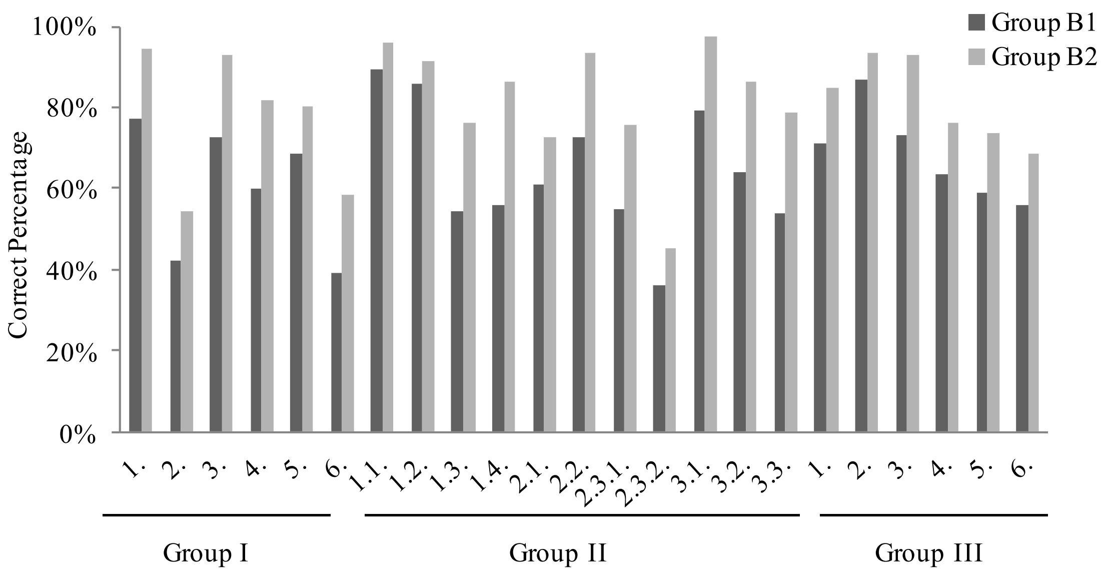


Figure 5.115. A bar chart of the percentage of correct item answers for Group B1 and Group B2.

In all the items of this sample the average performance level of Group B1 is lower than the performance level of Group B2. Once again the scores were transposed to the adapted scale following the previously described criteria.

Table 5.7 presents the average item grades achieved by Group B1 and the grading teachers (G.T.) estimates on the transposed scale of 17 to 74 points.

Table 5.7. Table of the average grades per item in the 17 to 74 points scale.

Physics Exam 1st Phase, 2005																							
	Group I						Group II											Group III					
	1	2	3	4	5	6	1.1	1.2	1.3	1.4	2.1	2.2	2.3.1	2.3.2	3.1	3.2	3.3	1	2	3	4	5	6
B1	0.8	0.4	0.7	0.6	0.7	0.4	3.6	3.4	2.2	2.2	2.4	2.9	2.2	1.4	3.2	2.6	2.2	2.8	3.5	2.9	2.5	2.4	2.2
G.T.	0.9	0.5	0.8	0.6	0.7	0.4	3.6	3.5	2.3	2.3	2.5	3.1	2.3	1.8	3.2	2.7	2.3	3.0	3.2	3.0	2.6	2.4	2.4

The average expected grades per item given by the grading teachers were considered in this process and it was determined that only item 2.3.2 had a lower than 50% expectation of getting a correct answer. On the other hand, the teachers' estimates were higher than the grades achieved by the examinees, with one exception: item 2 of Group III. A possible explanation for the higher than expected average grade in item 2, is the replacement of values in an expression. There is a higher concordance between the average grades of Group B1 and the grading teachers' expectations.

Considering the average grades of Group B1 (48 points) and of the Group of grading teachers (50 points), its weighted average is 49 points, the equivalent to 86 points in the 0 to 200 points scale. This value is lower than the average exam grade for Group B1 (113 points), despite the grading teachers' expectations.

In order to calculate the cut scores considering the average grades, the constant and slope values of the linear regression function had to be calculated, using the 0 to 200 points scale for Group B1 + Group B2 and using the 17 to 74 points transformed scale for the ensemble (Group B1 + Grading Teachers).

The results are shown in Table 5.8.

Table 5.8. Results of the binomial logistic regression.

	constant (a)	slope (b)	*cut score*
Group B1+ Group B2	- 6.834	0.062	120 points
Group B1 + Grading Teachers	-6.438	0.0103	68 points

The value of the cut score for the ensemble Group B1 + Grading Teachers, 68 points, equivalent to 131 points in the 0 to 200 points scale, was the expected value due to the high average item grades estimated by the grading teachers.

The same software used previously was applied to the analysis of the item answers, both to the examinees of Groups B1 and B2 and the examinees of Group B1 and the Grading Teachers.

The results of this analysis to the item answers are shown in table 5.9.

Table 5.9. Item answer analysis.

	constant (a)	slope (b)	*cut score*
Group B1+ Group B2	- 6.758	0.113	64 points
Group B1 + Grading Teachers	- 8.009	0.121	70 points

The cut score values for the ensembles are: Group B1 + Group B2, 64 points, equivalent to 127 points, Group B1 + Grading Teachers, 70, equivalent to 144 points in the 0 to 200 points scale. A variation of up to 6.5% can be observed when comparing the cut scores from the two previous tables due to the small number of examinees.

Keeping in mind the descriptive analysis of the two separate groups, in the sample and in the ENES, shown in figure 5.116, we can highlight the low range of the sample, with higher average results than the national average.

	Group B1		**Group B2**	
	sample	*ENES*	*sample*	*ENES*
Range	93	5325	55	2640
Mean	113	101	154	145
Maximum	190	196	197	200
Minimum	31	0	91	14
Median	117	102	158	151
Standard Deviation	33.0	35.5	22.7	34.3
Standard Error	3.43	0.49	3.06	0.67

Figure 5.116. Descriptive analysis of Group B1 and Group B2 (sample and ENES), in 2005 Physics exam.

Chemistry Exam 1st Phase, 1st call, 2003 (see tables 6.51 to 6.53)

Figure 5.117 provides the overall score distribution achieved by both Group B1 and Group B2 on the 2003 Chemistry Exam.

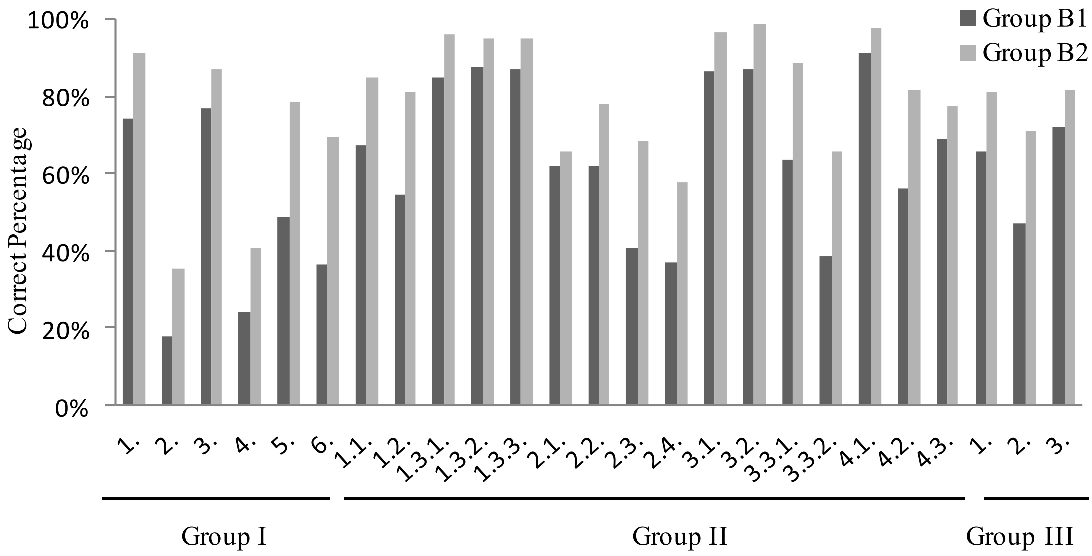


Figure 5.117. A bar chart of the percentage of correct item answers for Group B1 and Group B2.

In all the items of this sample the average performance level of Group B1 is lower than the performance level of Group B2. Once again the scores were transposed to the adapted scale following the previously described criteria.

Table 5.10 presents the average item grades achieved by Group B1 and the grading teachers (G.T.) estimates on the transposed scale of 18 to 82 points.

Table 5.10. Table of the average item grades (Group B1 and Group of Grading Teachers) on the 18 to 82 points scale.

Chemistry Exam 1st Phase, 1st call, 2003																									
	Group I						Group II																Group III		
	1	2	3	4	5	6	1.1	1.2	1.3.1	1.3.2	1.3.3	2.1	2.2	2.3	2.4	3.1	3.2	3.3.1	3.3.2	4.1	4.2	4.3	1	2	3
B1	0.7	0.2	0.8	0.2	0.5	0.4	2.7	2.2	3.4	3.5	3.5	2.5	2.5	1.7	1.5	3.5	3.5	2.5	1.6	3.7	2.3	2.8	2.6	1.9	2.9
G.T.	0.8	0.3	0.9	0.4	0.6	0.4	2.8	2.4	3.4	3.4	3.5	2.8	2.6	1.7	1.7	3.5	3.5	2.7	1.6	3.7	2.4	2.8	2.9	2.0	2.9

The average expected grades per item given by the grading teachers were considered in this process and it was determined that the items 4 (Group I), 2.3, and 2.4 had a lower than 50% expectation of getting a correct answer. On the other hand, the teachers' estimates were higher than the grades achieved by the examinees, with one exception: item 1.3.2 of Group II. A possible explanation for the higher than expected average grade in item 2.4, where the examinees where asked for the expression of the solubility product, Ks, of lead iodide (II), can be due to the memorization of the expression by the examinees.

Considering the average grades of Group B1 (53 points) and of the Group of grading teachers (55 points), its weighted average is 52 points, the equivalent to 83 points in the 0 to 200 points scale. This value is lower than the average exam grade for Group B1 (103 points), despite the grading teachers' expectations.

In order to calculate the cut scores considering the average grades, the values of constant a and slope b of the linear regression function had to be calculated, using the 0 to 200 points scale for Group B1 + Group B2 and using the 18 to 82 points transformed scale for the ensemble (Group B1 + Grading Teachers).

The results are shown in Table 5.11.

Table 5.11. Results of the binomial logistic regression.

	constant (a)	slope (b)	*cut score*
Group B1+ Group B2	- 6.342	0.055	124 points
Group B1 + Grading Teachers	-5.894	0.085	75 points

The value of the cut score for the ensemble Group B1 + Grading Teachers, 75 points, equivalent to 139 points in the 0 to 200 points scale, was the expected value due to the high average item grades estimated by the grading teachers.

The same software used previously was applied to the analysis of the item answers, both to the examinees of Groups B1 and B2 and the examinees of Group B1 and the Grading Teachers.

The results of this analysis to the item answers are shown in table 5.12.

Table 5.12. Item answer analysis results.

	constant (a)	slope (b)	*cut score*
Group B1+ Group B2	- 5.619	0.087	71 points
Group B1 + Grading Teachers	- 6.270	0.089	76 points

The cut score values for the ensembles are: Group B1 + Group B2, 71 points, equivalent to 130 points, Group B1 + Grading Teachers, 76, equivalent to 142 points in the 0 to 200 points scale. The maximum difference between cut scores is 3% when comparing the results of both linear regressions.

Chemistry Exam 1st Phase, 2004 (see tables 6.54 to 6.56)

Figure 5.118 provides the overall score distribution achieved by both Group B1 and Group B2 in the 2004 Chemistry Exam.

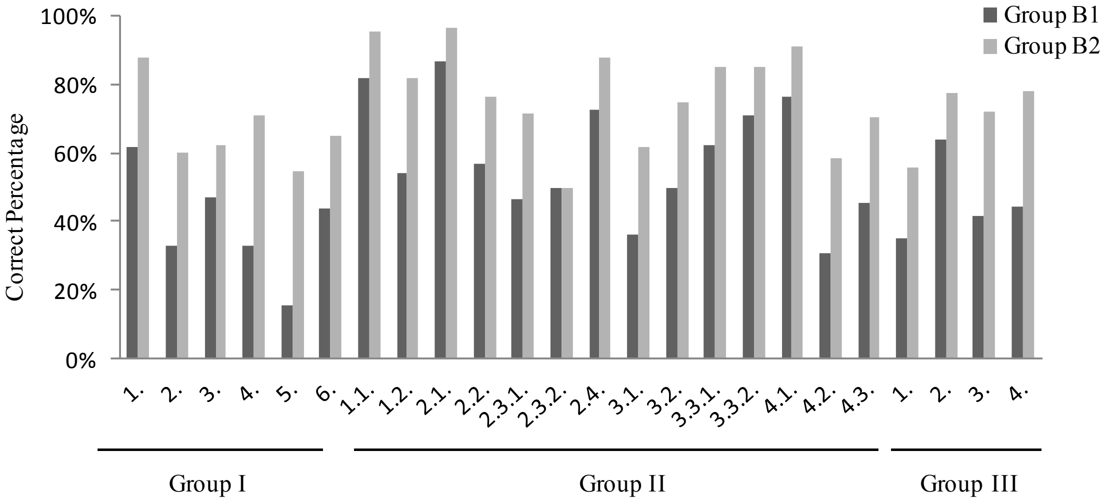


Figure 5.118 A bar chart of the percentage of correct item answers for Group B1 and Group B2.

In all the items of this sample the average performance level of Group B1 is lower or equal than the performance level of Group B2. Once again the scores were transposed to the adapted scale following the previously described criteria.

Table 5.13 presents the average item grades achieved by Group B1 and the grading teachers (G.T.) estimates on the transposed scale of 18 to 76 points.

Table 5.13. Table of the average item grades (Group B1 and Group of Grading Teachers) on the 18 to 76 points scale.

Chemistry Exam 1st Phase, 2004																									
	Group I						Group II														Group III			
	1	2	3	4	5	6	1.1	1.2	2.1	2.2	2.3.1	2.3.2	2.4	3.1	3.2	3.3.1	3.3.2	4.1	4.2	4.3	1	2	3	4
B1	0.6	0.3	0.5	0.3	0.2	0.4	3.3	2.2	3.5	2.3	1.9	2.0	2.9	1.4	2.0	2.5	2.8	3.1	1.2	1.8	1.4	2.6	1.7	1.8
G.T.	0.8	0.4	0.5	0.4	0.4	0.6	3.3	2.4	3.5	2.4	2.1	2.2	3.0	1.8	2.2	2.6	3.1	3.1	1.8	2.1	2.0	2.7	2.0	2.0

The average expected grades per item given by the grading teachers were considered in this process and it was determined that only item 4.2 had a lower than 50% expectation of getting a correct answer. On the other hand, the teachers' estimates were higher than the grades achieved by the examinees.

Considering the average grades of Group B1 (42 points) and of the Group of grading teachers (48 points), its weighted average is 46 points, the equivalent to 74 points in the 0 to 200 points scale. This value is lower than the average exam grade for Group B1 (83 points), despite the grading teachers' expectations.

In order to calculate the cut scores considering the average grades, the values of constant a and slope b of the linear regression function had to be calculated, using the 0 to 200 points scale for Group B1 + Group B2 and using the 18 to 76 points transformed scale for the ensemble (Group B1 + Grading Teachers).

The results are shown in Table 5.14.

Table 5.14. Results of the binomial logistic regression.

	constant (a)	slope (b)	*cut score*
Group B1+ Group B2	- 6.236	0.059	114 points
Group B1 + Grading Teachers	-6.563	0.101	70 points

The value of the cut score for the ensemble Group B1 + Grading Teachers, 70 points, equivalent to 137 points in the 0 to 200 points scale, was the expected value due to the high average item grades estimated by the grading teachers.

The same software used previously was applied to the analysis of the item answers, both to the examinees of Groups B1 and B2 and the examinees of Group B1 and the Grading Teachers.

The results of this analysis to the item answers are shown in table 5.15.

Table 5.15. Item answer analysis results.

	constant (a)	slope (b)	*cut score*
Group B1+ Group B2	- 6.324	0.110	62 points
Group B1 + Grading Teachers	- 7.392	0.103	76 points

The cut score values for the ensembles are: Group B1 + Group B2, 62 points, equivalent to 116 points, Group B1 + Grading Teachers, 76, equivalent to 138 points in the 0 to 200 points scale. The resulting cut scores from the binomial logistic regression and the item answer analysis have a maximum difference of 1%.

Keeping in mind the descriptive analysis of the two separate groups, in the sample and in the ENES, shown in figure 5.119, we can observe an approximation of the characteristics, even though the sample shows higher results than the national average.

	Group B1		Group B2	
	sample	*ENES*	*sample*	*ENES*
Range	172	9015	145	7905
Mean	83	76	138	129
Maximum	149	186	200	200
Minimum	13	0	54	0
Median	85	75	135	128
Standard Deviation	25.9	26.8	36.6	38.5
Standard Error	1.96	0.28	3.04	0.43

Figure 5.119. Descriptive analysis of Group B1 and Group B2 (sample and ENES), in 2004 Chemistry exam.

Chemistry Exam 1st Phase, 2005 (see tables 6.57 to 6.60)

Althogether 382 examinees were part of the sample and figure 5.120 provides the overall score distribution achieved by both Group B1 and Group B2 in 2005 Chemistry Exam.

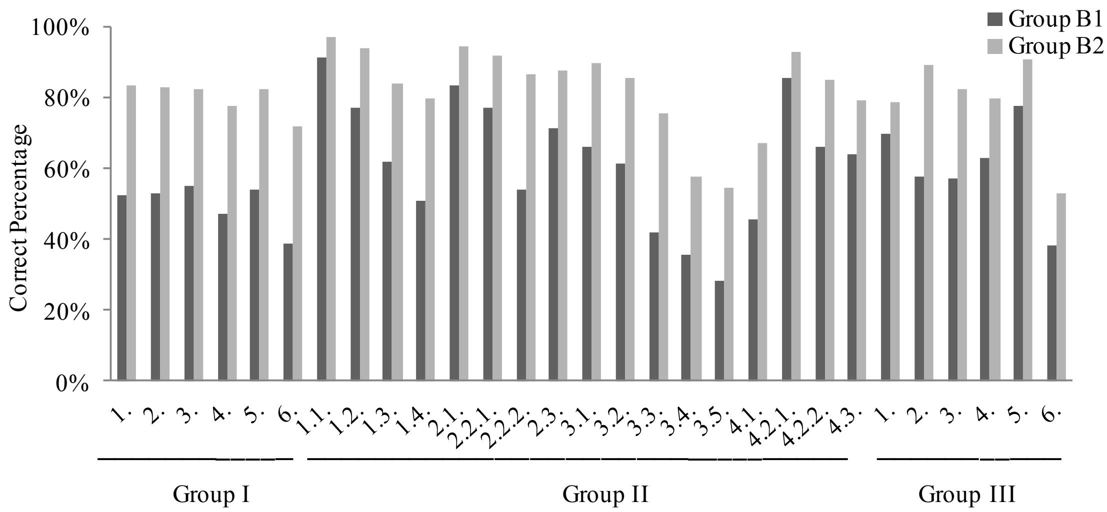


Figure 5.120. A bar chart of the percentage of correct item answers for Group B1 and Group B2.

In all the items of this sample the average performance level of Group B1 is lower or equal to the performance level of Group B2. Once again the scores were transposed to the adapted scale following the previously described criteria.

Table 5.16 presents the average item grades achieved by Group B1 and the grading teachers (G.T.) estimates on the transposed scale of 23 to 98 points.

Table 5.16. Table of the average item grades (Group B1 and Group of Grading Teachers).

	Chemistry Exam 1st Phase, 2005																												
	Group I						Group II																Group III						
	1	2	3	4	5	6	1.1	1.2	1.3	1.4	2.1	2.2.1	2.2.2	2.3	3.1	3.2	3.3	3.4	3.5	4.1	4.2.1	4.2.2	4.3	1	2	3	4	5	6
B1	0.5	0.5	0.6	0.5	0.5	0.4	3.7	3.1	2.5	2.0	3.3	3.1	2.2	2.9	2.7	2.5	1.7	1.4	1.1	1.8	3.4	2.6	2.6	2.6	2.3	2.3	2.5	3.1	1.5
G.T.	0.6	0.7	0.7	0.5	0.7	0.5	3.7	3.2	2.6	2.1	3.4	3.2	2.4	2.9	2.7	2.6	1.9	1.7	1.5	2.0	3.5	2.9	2.8	3.0	2.2	2.4	2.6	3.1	1.8

The average expected grades per item given by the grading teachers were considered in this process and it was determined that only items 3.3, 3.4, 3.5, and 6 had a lower than 50% expectation of getting a correct answer. On the other hand, the teachers' estimates were higher than the grades achieved by the examinees, except in item 2 from Group III. In this group, most of the items called for memorizing the naming of organic compounds, while the second item asked for the chemical equation of ethanol dehydration, which the teachers felt was a less accessible item.

Considering the average grades of Group B1 (60 points) and of the Group of grading teachers (49 points), its weighted average is 55 points, the equivalent to 65 points in the 0 to 200 points scale. This value is lower than the average exam grade for Group B1 (99 points), despite the grading teachers' expectations.

In order to calculate the cut scores considering the average grades, the values of constant a and slope b of the linear regression function had to be calculated, using the 0 to 200 points scale for Group B1 + Group B2 and using the 23 to 98 points transformed scale for the ensemble (Group B1 + Grading Teachers).

The results are shown in Table 5.17.

Table 5.17. Results of the binomial logistic regression.

	constant (a)	slope (b)	*cut score*
Group B1+ Group B2	- 6.416	0.056	126 points
Group B1 + Grading Teachers	-7.382	0.101	79 points

The value of the cut score for the ensemble Group B1 + Grading Teachers, 79 points, equivalent to 137 points in the 0 to 200 points scale, was the expected value due to the high average item grades estimated by the grading teachers.

The same software used previously was applied to the analysis of the item answers, both to the examinees of Groups B1 and B2 and the examinees of Group B1 and the Grading Teachers.

The results of this analysis to the item answers are shown in table 5.18.

Table 5.18. Item answer analysis results.

	constant (a)	slope (b)	*cut score*
Group B1+ Group B2	- 6.619	0.094	76 points
Group B1 + Grading Teachers	- 7.745	0.103	80 points

The cut score values for the ensembles are: Group B1 + Group B2, 76 points, equivalent to 128 points, Group B1 + Grading Teachers, 80, equivalent to 139 points in the 0 to 200 points scale. The resulting cut scores from the binomial logistic regression and the item answer analysis have a maximum difference of 1%.

Keeping in mind the descriptive analysis of the two separate groups, in the sample and in the ENES, shown in figure 5.121, we can observe an approximation of the characteristics, even though the sample shows higher results than the national average.

	Group B1		**Group B2**	
	sample	*ENES*	*sample*	*ENES*
Range	235	10221	147	8103
Mean	100	90	154	147
Maximum	185	196	198	200
Minimum	20	0	37	13
Median	99	89	161	152
Standard Deviation	34.6	32.9	33.7	34.4
Standard Error	2.26	0.33	2.78	0.38

Figure 5.121. Descriptive analysis of Group B1 and Group B2 (sample and ENES), for the 2005 Chemistry exam.

By considering the average item grades for examinees belong to Group B1 and the grading teachers, we can see that the weighted average is always lower than the average exam grade for examinees belonging to Group B1, despite the grading teachers' expectations. There is no meaningful discrepancy when comparing the results of the exam grade binomial logistic regression and the item answer analysis for the ensemble Group B1 + Grading Teachers.

Table 5.19 presents a summary of the cut scores, from the application of variations of the Contrasting Groups Method and the Extended Angoff Method to examinees from the Greater Lisbon area and the Beuk Method to all examinees, for internal students in the Physics and Chemistry exams between 2003 and 2005.

Table 5.19. Cut scores obtained for Groups B1+B2 by applying the Contrasting Groups Method, Extended Angoff Method, and Beuk Method.

		Samples of examinees from Lisbon Area				ENES
		Contrasting Groups Method		Extended Angoff Method		Beuk Method
		MCGM1	MCGM2	Binomial logistic regression of the exam grades	Binomial logistic regression of the item answers	
Physics	2003	98	99	113	112	---
	2004	118	114	115	118	96
	2005	127	123	120	127	104
Chemistry	2003	126	125	124	130	----
	2004	102	103	114	116	92
	2005	121	119	126	128	102

The cut scores for internal students obtained from MCGM1 and MCGM2 have a maximum difference of 2%, while the maximum variation for the Extended Angoff Method is 3.5% for the same samples. The cut scores obtained from the Extended Angoff Method are higher than the cut scores obtained from the application of the Contrasting Groups Method.

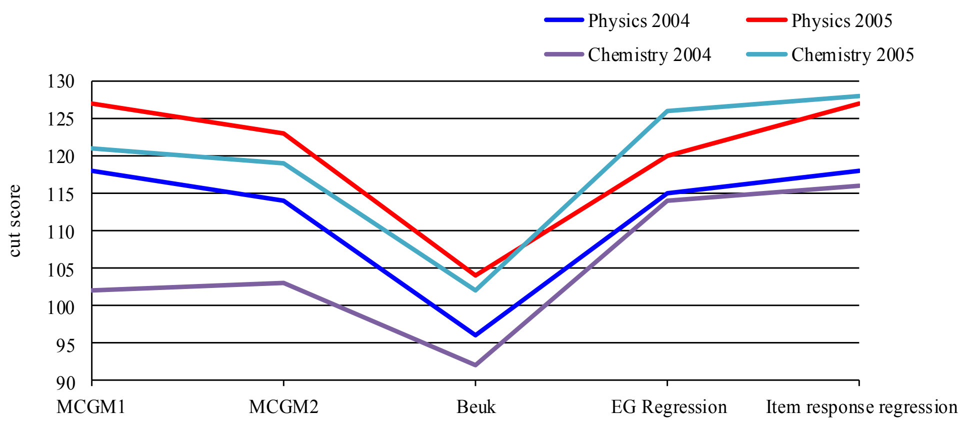


Figure 5.122. Cut scores for Groups B1+B2 obtained through the application of the Contrasting Groups Method, Extended Angoff Method and Beuk Method.

The Beuk cut scores (fig. 5.101. to fig. 5.104.) are lower than the cut scores obtained by the other methods (fig. 5.122). These cut scores were calculated for all the examinees (ENES), whereas the other cut scores were calculated for a small sample of examinees from the Greater Lisbon area. It should be pointed out that the cut scores obtained through the Beuk Method and the Contrasting Groups Method are very close for samples with less than 500 elements.

5.4 Content and cognition level of exams items

The statistical analysis of the results comprised of the following parameters: (a) difficulty index; (b) discrimination index; (c) mean, standard deviation, variance, and standard error of the total number of right answers on each item, answer that were blank were considered wrong; (d) and the point biserial coefficient which measures the correlation between the correct answer in the item and the final grade in the exam.

Physics: Unit 1 – 2E – Rotational Motion

All the items referring to the selected content measure higher-level thinking, i.e., they require the application of principles. The analysis of the examinees' performance in items P1, P3, and P5 allowed the construction of the graphic show in Figure 5.123.

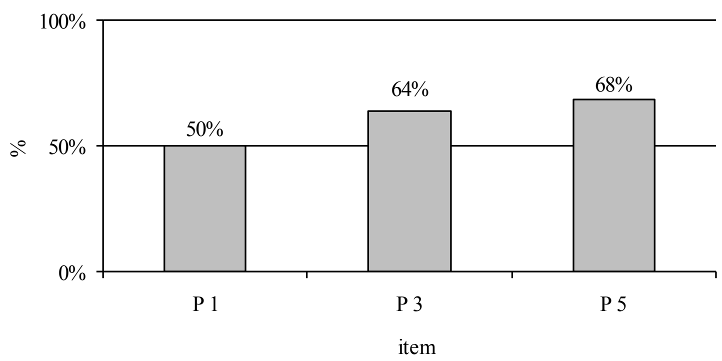


Figure 5.123. A bar chart of the percentage of correct item answers for P1, P3 and P5 items.

The three items in this sample have a varying complexity, although the average number of right answers is 50% or higher, which allows for a higher discrimination and increases its selective character. Regarding content, items P1 and P3 were problem solving items, whereas item P5 was considered by the grading teachers as a comprehension item. These results are conditioned to the number of items, duration, format, and difficulty of the 2003, 2004, and 2005 exams.

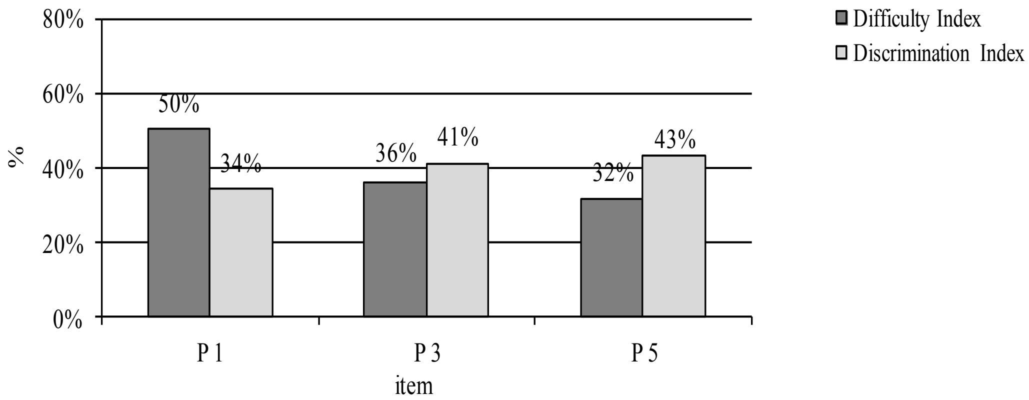


Figure 5.124. A bar chart of the difficulty index and discrimination index for items P1, P3 and P5.

As shown in Figure 5.124, the item difficulty index values vary from 0.32 to 0.50. Among all the items, P5 (2005) apparently is the least “difficult” item in Rotational Motion multiple choice items. All the items referring to the selected content measure higher-level thinking, i.e., they require the application of principles. It is common practice to reject items with a difficulty rating in the intervals [0; 0.3] and [0.80; 1]. Generally, the average item difficulty index value is 0.39, which falls into the criterion range. This result shows that these items have low difficulty and discrimination levels, for these examinees.

Table 5.20 shows the mean, standard deviation, variance, standard error, and point biserial coefficient values for the P1, P3 and P5 items.

Table 5.20. Statistical parametres for items P1, P3, and P5.

Item	P1	P3	P5
Number of examinees	275	251	148
Mean	5.0	6.4	6.8
Standard Deviation	5.0	4.8	4.7
Variance	25.1	23.2	21.8
Standard Error	0.30	0.30	0.38
point biserial coefficient	0.259	0.239	0.346

The psychometric parameters found reasonably satisfy the requirements of the measurement devices. The average of right answers in item P1 (4.98) is the same as the medium point of the scale (5.0), with a standard deviation of 5. Item P1 was deemed to have a high difficulty level. The value of the point biserial coefficient should be higher than 0.2 (Kline, 1986), which happens in item P1 (0.25), reflecting the correlation between an individual item and the entire test.

The average of right answers in item P3 (6.37) is higher than the medium point of the scale (5.0), with approximately the same standard deviation as P1 and P5. Item P3 was deemed by the grading teachers as having a medium difficulty level. On the other hand, the point biserial coefficient (0.24) is different from the value for P1 by two decimal points.

Item P5, considered to have a medium difficulty level by the grading teachers, revealed itself to be accessible to these examinees. The average of right answers (6.82) is high and the standard deviation is 5. The value of the point biserial coefficient (0.35) is the highest for this group of items.

Physics: Unit 2 – 1 – Gravitation

All the items referring to the selected content measure higher-level thinking, since they require the application of concepts or principles. Figure 5.125 shows the percentage of correct item answers for items P2, P4, and P6.

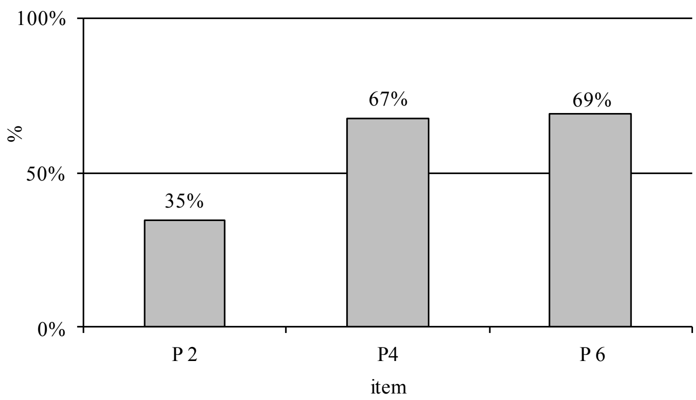


Figure 5.125. A bar chart of the percentage of correct item answers for items P2, P4, and P6.

The three items in this sample have a varying complexity. Items P4 and P6 have an average of right answers of 50% or higher, item P2 has a low average of right answers (34.5%). Regarding content, the three items were problem solving items, whereas item P5 was considered by the grading teachers requiring only concepts, at the cognition level.

Figure 5.126 shows the difficulty index, discrimination index of for the analysis of items P2, P4 and P5.

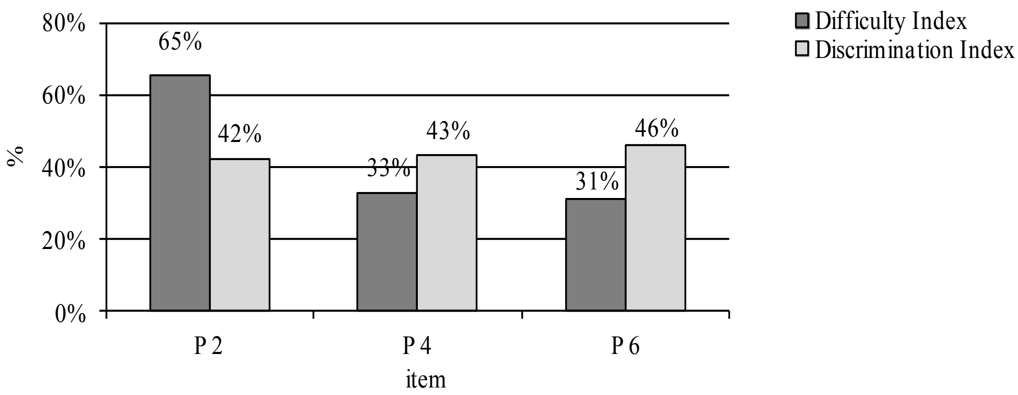


Figure 5.126. A bar chart of the difficulty index and discrimination index for items P2, P4 and P6.

As shown in Figure 5.126, the item difficulty index values vary from 0.31 to 0.65. Among all the items, P2 is apparently the most "difficult" item in Gravitation multiple choice items. Items P2 and P4 measure higher-level thinking and item P6 requires the application of concepts. The average item difficulty index value of the three items is 0.43, which falls into the criterion range [0.30; 0.80]. This result shows that these items have reasonable difficulty and discrimination levels.

Table 5.21 shows the mean, standard deviation, variance, standard error and point biserial coefficient values for items P2, P4 and P6.

Table 5.21. Statistical parametres for items P2, P4, and P6.

Item	P2	P4	P6
Number of examinees	275	251	148
Mean	3.4	6.7	7.3
Standard Deviation	4.8	4.7	4.5
Variance	22.6	22.1	19.9
Standard Error	0.29	0.30	0.37
point biserial coefficient	0.442	0.562	0.389

Although for P6 the number of examinees is low, the psychometric parameters found reasonably satisfy the requirements of the measurement instruments. The average of right answers for item P2 (3.43) is lower than the medium point of the scale (5.0), with a standard deviation of 5. Item P2 was considered to be of high difficulty. The value of the point biserial coefficient should be higher than 0.2 (Kline, 1986), which happens for item P2 (0.44), reflecting an acceptable correlation between an individual item and the entire test.

The average of right answers for item P4 (6.73) is higher than the medium point of the scale (5.0), with a standard deviation of approximately 5. The grading teachers considered item P4 as being of medium difficulty. On the other hand, the point biserial coefficient (0.56) is the highest of all the physics items. It was not possible to do biserial point correlations due to the lack of data regarding the answer to each descriptor.

Item P6 (2005), considered by the grading teachers as being of medium difficulty, turned out to be the most accessible Physics item. The average of right answers (7.30) is high and the standard deviation is 4.5. The value of the point biserial coefficient (0.39) is the lowest for this group of items.

The examinees' performance in this sample varied considerably in the six chosen items chosen from the 2003 to 2005 Physics exams. There was also, in Physics, a great variation at the national level of the "difference of results of the national average between the IFG and EG, with their behaviour disagreeing with that of other subjects" (Martinho, 2009, p. 158). It was verified that the highest values of the difficulty level were found in 2003 (items P1 and P2), in line with the grading teachers' expectations as they considered the items from that year to be harder. As a consequence the values of the discrimination index were lower for both items. In 2005, items P5 and P6 presented lower difficulty index values, although the discrimination index values stayed basically the same.

In both the 2004 and 2005 Physics exams the percentage of correct item answers was higher than 60%. The guessing factor was not considered in this analysis of multiple choice items. The choice of a wrong answer was not penalized so there could be certain random adjustments that are difficult to detect as there is no justification required for the choice of one of the five possible answers presented on each item.

There was a unique situation detected in school 8 for the 2005 exam (items P5 and P6). Upon analysing the results it was verified that more than 20 examinees taking the Physics exam in 2005 had an IFG lower than 130 points in the 200 points scale (minimally competent students). All these examinees achieved a higher than 130 points EG, with one of the examinees who had an IFG of 110 points achieving the maximum grade of 200 points. The analysis of the resolution of this test revealed that the examinee had a great creative capacity for problem solving. According to the school board, a possible explanation for this point difference between the IFG and the EG was the extremely high demand level of one the faculty members who taught at the school, leading the majority of students to take the exam as external students. As this study focuses exclusively on internal students, it led to a very small sample of examinees for the 2005 Physics exam.

Chemistry: Unit 2 – Inter-molecular Bonds and Gas Laws

All of the items referring to the selected content measure higher-level thinking, since they require the application of concepts or principles. Figure 5.127 shows the percentage of correct item answers for items C1, C3, and C5.

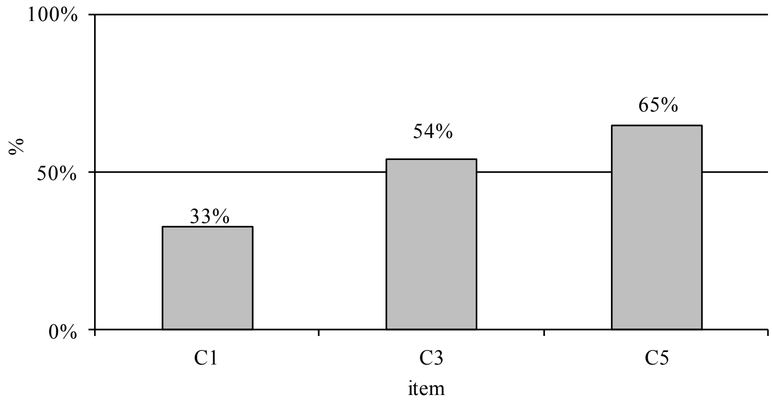


Figure 5.127. A bar chart of the percentage of correcte item answers for items C1, C3, and C5.

The three items in this sample presented different complexity levels. Item C1 presented a low percentage of correct answers (32.7%), while items C3 and C5 showed a percentage of correct answers higher than 50%. Taking a look at content, item C1 required problem solving, while items C3 and C5 where considered by the grading teachers to simply require concepts, at the cognitive level.

Figure 5.128 shows the difficulty index and discrimination index for the analysis of items C1, C3, and C5.

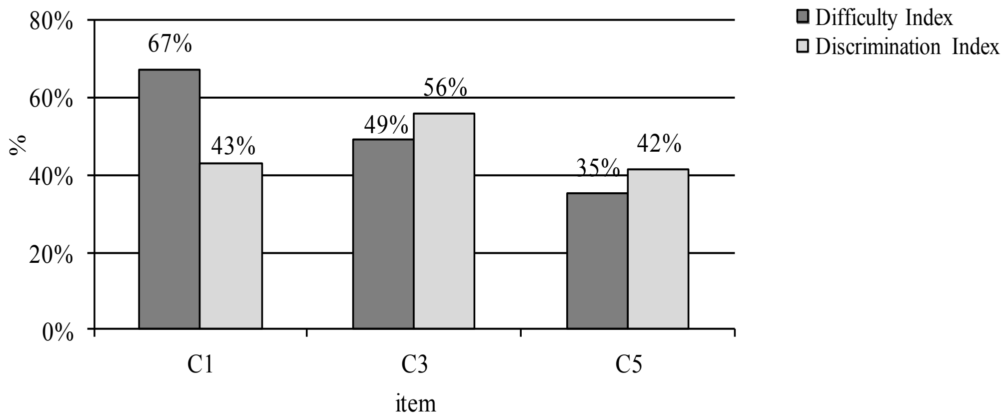


Figure 5.128. A bar chart of the difficulty index and discrimination index for items C1, C3, and C5.

As shown in Figure 5.128, the item difficulty index values vary from 0.35 to 0.67. Similarly to what happened with the Physics contents, item C5 (2005) is apparently the least “difficult” item of these multiple-choice items. All the items referring to the selected content measure higher-level thinking, i.e., they require the application of concepts or principles. The average item difficulty index value is 0.50, which falls into the criterion range. This result shows that these items have a reasonable difficulty and discrimination levels, for these examinees.

Table 5.22 shows the mean, standard deviation, variance, standard error and point-bi serial coefficient values for the items C1, C3, and C5.

Table 5.22. Statistical parametres for items C1, C3, and C5.

Item	**C1**	**C3**	**C5**
Number of examinees	153	317	382
Mean	3.3	5.4	6.5
Standard Deviation	4.7	5.0	4.8
Variance	22.1	24.9	22.9
Standard Error	0.38	0.28	0.245
point biserial coefficient	0.424	0.442	0.510

Although for C1 the number of examinees is low, the psychometric parameters found reasonably satisfy the requirements of the measurement instruments. The average of right answers for item C1 (3.27) is lower than the medium point of the scale (5.0), with a standard deviation of 5. Item C1 was considered to be of high difficulty. The value of the point biserial coefficient for item C1 (0.42), reflects an acceptable correlation between an individual item and the entire test.

The average of right answers for item C3 (5.39) is higher than the medium point of the scale (5.0), with a standard deviation of approximately 5. The grading teachers considered item C3 as being of medium difficulty. On the other hand, the point biserial coefficient (0.44) is higher than the required minimum (0.2).

Item C5 (2005) considered by the grading teachers, similarly to item C3, as being of medium difficulty, was the most accessible of these contents. The average of right answers (6.47) is high with a standard deviation of 5. The value of the point biserial coefficient (0.51) is the highest for this group of items.

Chemistry: Unit 5 – Energy and Entropy in Chemical Reactions

Items C2, C4, and C6 measure higher-level thinking requiring both concepts and principles. Figure 5.129 shows the percentage of correct item answers for items C2, C4, and C6.

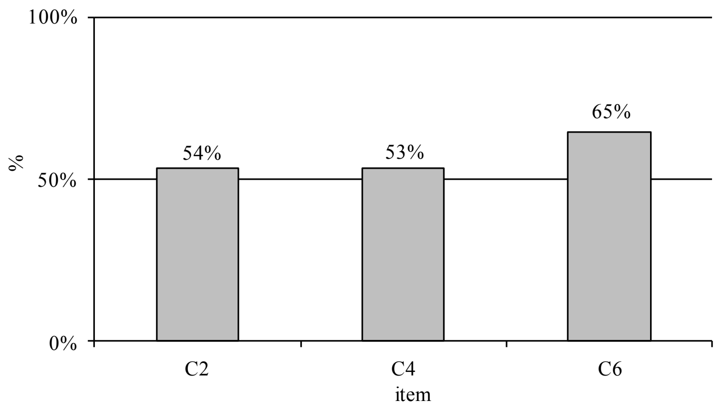


Figure 5.129. A bar chart of the percentage of correcte item answers for items C2, C4, and C6.

The three items in this sample presented different complexity levels, although the average of right answers is 50% or higher, which allows for better discrimination and increases its selective character. Regarding content, items C4 and C6 required problem solving, while item C2 was considered by the grading teachers as an analysis item.

Figure 5.130 shows the difficulty and discrimination indexes for the analysis of items C2, C4, and C6.

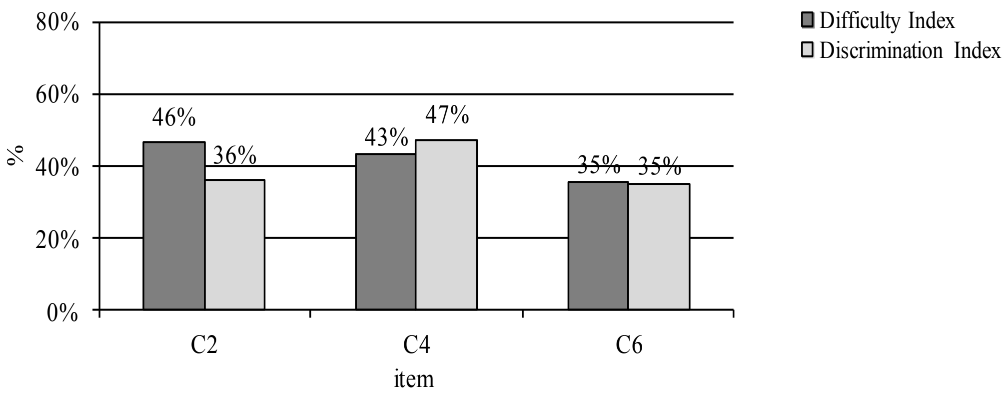


Figure 5.130. A bar chart of the difficulty and discrimination indexes for items C2, C4, and C6.

As shown in Figure 5.130, the item difficulty index values vary from 0.35 to 0.46. Among all the items, C6 (2005) apparently is the most “difficult” item in the Energy and Entropy in Chemical Reactions multiple-choice items. Items C4 and C6 measure higher-level thinking and item C2 requires the application of concepts. The value of the average item difficulty index of the three items is 0.41, which falls into the criterion range [0.30; 0.80]. This result shows that these items have reasonable difficulty and discrimination levels.

Table 5.23 shows the mean, standard deviation, variance, standard error and point biserial coefficient values for items C2, C4, and C6.

Table 5.23. Statistical parametres for items C2, C4, and C6.

Item	C2	C4	C6
Number of examinees	153	317	382
Mean	5.4	5.3	5.2
Standard Deviation	5.0	5.0	5.0
Variance	25.0	25.0	25.0
Standard Error	0.40	0.28	0.26
point biserial coefficient	0.337	0.411	0.559

The psychometric parameters found reasonably satisfy the requirements of the measurement instruments. The average of right answers for item C2 (5.36) is close to the medium point of the scale (5.0), with a standard deviation of 5. Item C2 was considered to be of medium difficulty. The value of the point biserial coefficient for item C2 is 0.34, reflecting an acceptable correlation between an individual item and the entire test.

The average of right answers for item C4 (5.33) is close to the medium point of the scale (5.0), with the standard deviation being practically the same as for C2 and C6. Item C4 was considered by the grading teachers to be of medium difficulty. On the other hand the value of the point biserial coefficient (0.41) is between the values of C2 and C6.

Item C6 was considered by the grading teachers to be of medium difficulty and, similarly to items C2 and C4, had an average of right answers (5.25) close to the medium point of the scale (5.0) and a standard deviation of 5. The value of the point biserial coefficient (0.56) is the highest for this item group.

The percentage of correct item answers in five of the six Chemistry items, between 2003 and 2005, is higher than 50% and lower than 65%, revealing the medium difficulty of those items. Item C1 distinguishes itself from the remaining items by having a difficulty index higher than 65%, agreeing with the grading teachers' expectations that pointed to a high difficulty level.

Another pertinent question relates to the characterization of the results obtained at national level by the target-schools in this study. According to a study performed by Martinho (2009, p. 197) between 1999 and 2005, four target-schools are amongst the 18 better performing schools in the country, six amongst the 48 schools with good performance, and the remaining six in the group of schools with an average performance. In order to illustrate the performance of the target-schools, the average values of the difference between the sampled examinees' internal final grade (IFG) and their exam grade (EG) and the average values presented by Martinho (2009, p. 158) for all the internal examinees that took these exams are shown in table 5.24.

Table 5.24. Average values of the difference between IFG and EG on the 200 points scale.

	Physics		Chemistry	
	sample	national	sample	national
2003	38.6	45.7	13.5	28.3
2004	10.4	21.2	28.1	39.6
2005	-10.5	6.5	9.1	20.1

The year 2005 shows the smallest difference between IFG and EG, both for Physics and Chemistry, revealing a better performance by those examinees. The difference between the sample and national values is due to the fact that the examinees from the target-schools had a performance above the national average. The inversion seen in the 2005 Physics exam when compared to the 2003 exam is quite surprising. From the analysis of the table it can be seen that the biggest difference between IFG and EG for Chemistry happens in 2004, both at the sample and national levels.

Regarding the values of the point biserial coefficient, which measures the correlation between right answer and the total grade in the exam for each examinee, we can see that there is a higher correlation in the 2005 Chemistry exam (C5 and C6). The same cannot be said about the Physics exam as the Gravitation content (P6) from 2005 leads to a lower correlation when compared to previous years.

In Chapter 5.3 the behaviour of the sampled internal students divided into two groups (B1 and B2) was analysed using the Extended Angoff Method. Table 5.25 shows the differences between the cut score values for the EG (groups B1+B2) and for the IFG (130 points) which was the basis for the distinction between both groups.

Table 5.25. Average values of the difference between IFG (130 points) and the cut scores for Groups B1+B2, in the 200 points scale.

	Physics	Chemistry
2003	17	6
2004	15	16
2005	10	4

There is a less pronounced decrease in the Physics exams between 2003 and 2005 when compared to the values from Table 5.25, obtained from the average of the difference between IFG and EG in each exam. Regarding the Chemistry exam, it is possible to identify a pattern according to which, in 2004, the value of the difference increases when compared to 2003 and then decreases in 2005. There are no identical behaviours, during the three years studied, for each of the selected contents. Still, it can be seen that in 2005 the psychometric parameters are better than in 2004. One possible explanation is that these were exams last exams before the change in curriculum that happened in the 2005-2006 school year.

From the analysis performed to all items, either on the value of the average item difficulty index, or on the value of the discrimination index, all were inside the criterion range, hinting at the balance of the selected items conception. One should not exclude the possibility of obtaining different results by, for instance, including external students or selecting other contents.

6 Conclusions

> "Students need ideas - not a single view but discussions of views - concerning: laws in science, the relationship between experiment and theory, and the strong distinction between theory and simple hypotheses. For these benefits students must be carried through actual examples, not just harangued or given put definitions."(Rogers, 1960, p. 30)

The results of this study suggest a higher specialization of the grading teachers to promote the attainment of cut scores closer to the values of the examinees, as well as the application of other mixed methods, considering different samples.

The goal of grading should not be only to highlight eventual differences but to properly interpret them so that effective decisions in the teaching and learning process can be taken. If, on one hand, a higher level of demand can have negative consequences and lead to deception and indifference in the subject by the students, on the other hand, the performance level of the examinees should reflect and encourage learning activities associated to more complex skills so that evaluation can model the learning.

In the spirit of openness and of a road to be travelled and understanding that learning practices are inseparable from evaluation and their social use, some research orientations and horizons are presented which can eventually emerge from this study.

6.1 Major Findings

The brief analysis of the legislation starting in 1836 allowed understanding the evolution of the norms regulating exams, in general, and national exams, particularly. Although the national exams have contributed to better know “the students’ understanding of school subject curricula, signal educational goals to work toward, and provide instructionally valuable feedback” (Chudowsky & Pellegrino, 2003), the low results obtained by the students should lead to a reflection about what exams should be measuring. Changes in the Physics and Chemistry curricula complicate the study of educational performance trends. To study trends, it is important to keep the assessment constant (Beaton & Zwick, 1990) but to maintain validity the assessment should be congruent with current educational practices. There are countless personal, material, and institutional obstacles that influence teaching practices. For many years encyclopaedic teaching, directed towards an elite, was incapable of considering the different interests and values of those who attended it. Nowadays, “teachers are asked to assume multiple and often contradictory roles, including, among other things, providing academic instruction; maintaining order in the classroom; attending to the social and emotional well-being of students; and meeting sometimes conflicting expectations of students, administrators, parents, and the community” (Smylie, 1999, p. 66).

The Portuguese educational system is based on, according to Valente (2011), “regimen of intensive exam correction, an unavoidable regulatory instrument, of accountability and incentive to all school life, which will finally generate good results.” Still, these good results, expected for years, are still missing both in Physics and Chemistry. The students study to reach goals, if the probabilities of success are minimal, there is no motivation to study these subjects. The practice of lowering the demand level is usually evoked to justify some academic success, hence the importance of analysing the items and the curricular contents found in the exams (Chapter 3) and the results achieved by the students (Chapter 4).

The grading, once seen by the teachers as a dialogical instrument, leads to a reflection of the daily practices, allowing for change both in the grading as in the curricula. Phillips (1996, p. 19) referred the relationship of test content with the underlying curriculum as an evidence of curricular validity, and is often labelled “opportunity to learn” (OTL). According to Fernandes (2004, p. 14) and Valadares & Graça (1998, p. 41) there is an ever greater tendency in the European educational systems regarding the “«inevitability of coexistence» of the psychometric paradigm, in the field of external grading with effect on the student progression, with the paradigm of the so called alternative, authentic, educational, or contextualized grading, of constructivist and cognitive inspiration" (Gipps & Stobart, 2003; Horn et al., 2000; Kellaghan & Madaus, 2003; Mislevy, Wilson, Ercikan, & Chudowsky, 2003). It's a hard task but "a teacher, who can record a pupil's performance over time and in several contexts, and who can discuss idiosyncratic answers in order to understand the thinking behind them, can build up a record of far better reliability than any external exam can achieve" (Jennison & Ogborn, 1994, p. 69). It is urgent to examine the current policy and practice since

> "… the national exams of Secondary School are a task that mobilizes a significant quantity of resources, both human and economical, and the fact that a policy for the assessment test was never clearly defined, can explain why the discussion about assessment as a regular element in classroom work was never heard of again." (Carvalho, 2010, p. 123)

Another fact that should be highlighted in these five decades is the extension and incoherence of the curricula, not only due to the lack of articulation with the subject of Mathematics, but also due to the juxtaposition of different notions from several time periods and cultural models (Duarte, 1997, p. 496). The presentation of examples of items (fig.3.2, and p. 51, p. 54 and p.56) with undesirable psychometric properties and revealing these problems helped illustrating the selective qualities of the national exams. Another revealing issue is the interest for lab work: for students, both in Physics as in Chemistry, the lab component was mainly a nasty exercise, devoid of any intrinsic interest. The student followed a set of prescribed stages, and aroused a little wiser. The end of the experimental component in the national exams was an escape from this problem. But, according to Jennison and Ogborn, "our students need to come to grips with the real physical world, not to base their knowledge of it on lectures (even with demonstrations) and textbooks." (1994, p. 86) Teachers should be vigilant "in the use of their content knowledge, whether in the laboratory or in the classroom"(Thorndike & Hagen, 1977). The scientific skills mean "critical thinking, imagination, intuition, playfulness, and thinking on your feet and with your hands that are essential to success in scientific research." According to Bower,

> "There is no more effective means to convey the excitement of science than to let teachers and their students really do science where doing is dependent on involvement in an open-ended, inquiry-based, student-driven exploration of almost any subject." (2001, p. 9)

The comparison between the results of different exams has been done for over a hundred years and since then much has been learned. There is clear progress regarding the objectivity of the grading in the period studied, not only through the improvement of technical aspects such as test writing and the agreement amongst examiners as to grading criteria and point distribution, but also through the importance given to the development of psychometric tools to gauge student performance.

The application of the Contrasting Groups Method allowed seeing two distinct groups of students: internal and externals students (fig. 5.12, fig. 5.33, fig. 5.63, and fig. 5.93), and also internal students with internal final grades generally higher than the exam grades. The cut scores for internal students obtained from MCGM1 and MCGM2 have a maximum difference of 2%, while the maximum variation for the Extended Angoff Method is 3.5% for the same samples. (Table 6.1) The cut scores obtained from the Extended Angoff Method were higher than the cut scores obtained from the application of the Contrasting Groups Method.

The Beuk cut scores (fig. 5.101. to fig. 5.104.) are lower than the cut scores obtained by the other methods (fig. 5.121). These cut scores were calculated for all the examinees (ENES), whereas the other cut scores were calculated for a small sample of examinees from the Greater Lisbon area. It should be pointed out that the cut scores obtained through the Beuk Method and the Contrasting Groups Method are very close for samples with less than 500 elements.

The cognitive analysis showed that there are no identical behaviours, during the three years studied, for each of the selected contents (p. 172).

Other conclusions also emerged:

A - A similarity between the results achieved by these three methods, namely when the sample includes more than 250 individuals;

B - The teacher expectations are generally very high compared to the results achieved;

C - In this study, the statistical methods gave results suggesting that Physics had been harshly graded, especially in the late 90s, and consistent results of all examinees have not been observed from 2003 to 2005;

D - There are differences in the average grade of the polytomous items. The lower grades in the items related to the experimental component of the curriculum is an indicator of the need to promote the development of skills in that area. The basis of this kind of studies is the concept that the primordial reason for the evaluation of the quality of teaching is to improve learning.

The evolution in cognitive sciences aroused skills that distinguish barely competent from competent examinees in particularly “subject domains, and advances in measurement and technology have extended the capability to collect and interpret more complex forms of evidence about student performance” (Minstrell, 2000). This study suggests also that is worthy to analyse cognitively items of Physics or Chemistry exams before and after the exams in order to understand the scores obtained by the examinees.

Concluding, this study is a pro-active and reactive reflection on the Physics and Chemistry national exams up to 2005, providing a vast source of information and opening avenues for future studies, such as:

- Studies on the curricular reforms in Physics and Chemistry;

- Studies on the writing of items;

- Comparative studies of the European and Non-European grading policies.

In future years, some of the recent advances will be viewed from a broader perspective, with new approaches surrounding score comparison. Comparable scores are, and always will be essential to help answer many questions of interest in education and society (Holland & Dorans, 2006, p. 217).

6.2 Limitation of the Study and Suggestions for Further Research

To research this theme through such a broad time period, even with some methodological and information constraints, presented an opportunity to reflect on and deepen the understanding the different competences mobilised in grading and provide knowledge for those who wish to maximize educational outcomes.

Globally, the testing Portuguese regime is characterised for “emphasizing the grading, selection, and certification processes, as well as the results achieved by the students”, (Fernandes, 2007, p. 123) and “is oriented toward the generation of items that can fulfil limited purposes”, are only used one time and then are discarded. This option is one of the limitations of this longitudinal study regarding national exams, as to its relative weight and its interdependence.

The main problem in this study of comparability of grades is what is meant by "comparable." There are several definitions of comparability and the selection and application of several statistical methods aimed to include psychometric tools consistent with the collected data. It was also aimed to have the available judges validate reliable judgments of appropriate cutting scores. This approach based on judgments was not completely successful since the expected scores by the teachers were always higher that the ones achieved by the examinees. It is possible that with further refinement of the procedures and special training of judges, the difficulties brought about by different standards in grading might be overcome. It is important to provide score feedback on an annual basis, and make systematic judgments and statistical comparisons to improve future scores.

On the other hand, the analysis is limited to a sample that includes a group of schools from the Lisbon area (p.171), where examinees had a superior average performance to the national average (Martinho, 2009). This choice is controversial because there are demographic and economic differences between populations, (Finn, 2004) suggesting further study of differences in educational performance in other areas of Portugal. In the period this investigation focuses in there was an increase in the education of the population and, consequently, an increase in literacy. Still, it was not possible to find interdependence between the increase of compulsory schooling and the results of the national exams.

An exam centred perspective is a particularly reductive view, as it doesn't question the contribution of other factors in the promotion of the teaching-learning process. As Shepard remarked, "assessment cannot promote learning if it is based on tasks or questions that divert attention from the real goals of instruction"(2006, p. 629). Traditionally, exam items often misdirected teaching focusing what was easiest to measure instead of what was important to learn. Classroom teaching should engage students in learning activities, should be as directly as possible focused on mental representations of the real goals for learning. On the other hand, "it is a shame that the socialising character of school, the informal experiences lived there, forming or deforming, is neglected. One talks almost exclusively of the teaching of contents." (Freire, 1997, p. 47) Some "efforts to change science teaching in public schools" (Beichner, 1994)had success when connected with new technologies. Technology could create over time a database about how students achieved their goals "while engaged in important learning activities. Information for assessment purposes could be extracted from this database and used to serve both classroom and external assessment needs"(Pellegrino, 2006).

Teachers play a key part in the renovation of teaching-learning and,

> "(...) among other methods, being part of a network allows them to improve the quality of their teaching and supports their motivation. Networks can be used as an effective component of teachers' professional development, are complementary to more traditional

> forms of in-service teacher training and stimulate morale and motivation." (Report, 2007, p. 3)

Without question, improvements in the grading process will face some challenges. The grading reform process can begin with a bottom up approach, starting from the student. One of these tasks is organizing a coherent and more coordinated global grading system based on analytic procedures and tools suitable for the task. Another no less important task is a reflexion on the part exams and grading play in society. The national exam scores have real effects on college admission, performance, and course choice, and improved performance will have an impact not only in increased literacy but also in the country's development. The realization of this problem is essential to creating a public debate regarding the social and public goals of academic achievement. No less important is the alteration of the item building and single-use exam paradigm, and the investment in designing trustworthy instruments, following Rasch's models, for instance, that will be reusable. The family of Rasch models (Rasch, 1977) provides a compatible basis for quantitative measurement in a probabilistic framework (Fischer, 1995; Perline, Wright, & Wainer, 1979). It will be necessary to analyse the cost-benefit and to discuss the "long-term benefits of a new model of assessment", and particularly "assessment practices that can directly support enhanced outcomes for individual students"(Pellegrino, 1999).

Computers have been used for over half a century for scoring and analysing test results. In some countries however, they are used to administer tests as well. The computer offers the capability of presenting item formats that go well beyond those used for paper and pencil (P&P) tests; for instance, it is possible to use computers to test how examinees perform in simulated scenarios. Using

> "new assessment technologies, schools might no longer have to interrupt the normal instruction process at various times during the year to administer external tests to students, let alone spend large amounts of time preparing to take such tests."(Chudowsky & Pellegrino, 2003)

Like in the United States, the recent Portuguese legislation emphasizes the setting of high academic standards and measuring students' attainment of those standards, reinforces the needs to clarify and focus educational goals. Unfortunately, the new requirements for assessment tests for multiple grades, such as testing all students in 4th grade in Mathematics and Portuguese and also in 9th, 10th, and 11th grades in Physics and Chemistry among other subjects present some real dangers such as Popham remarked (Popham, 2004). Hopefully, education leaders might accept the need to invest "time and resources to pursue the improvement of large-scale" assessments “so it can provide the information needed to help all students learn and succeed in school” (Popham, 2001).

Consequently, the conclusion of this study represents, besides the personal gain and improvement, the opportunity to implement teaching based on broadening the learning possibilities, considering grading as one more instrument providing individual feedback on a student to reflect on their level of knowledge and understanding.

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Appendix

Appendix 1 – Digital Exam Archive

When it came time to build the website two questions needed to be answered:

1. What is the best structure to make the information easily accessible?

2. Which software/programming language will be best to build the website?

To address the first question the website was structured to make the search as intuitive as possible. The menu was organized by decades according to the type of exam and the Reforms of the Educational System: 1931-1949; 1950-1959; 1960-1974; 1975-1979; 1980-1990; 1991-2000; and 2001-2005. There is no explicit separation on the menu between the district level exams and national exams before the Reform of Pires de Lima. That information is given on the introduction, transcribed here:

> "This website is meant to offer access to all the Physics and Chemistry exam sheets from 1931 to 1949 at a district level, as well as all the national exams from 1950 to 2005. The research and scanning of these exams, which span over 50 years, was only possible due to the much-appreciated help of several institutions as well as to a number of Physics and Chemistry teachers.
>
> This online digital archive is part of a study on Physics and Chemistry national exams, by Cecília Silva, under the guidance of Professor Vítor D. Teodoro."

To make the division clearer, the 1948 Physics and Chemistry 2nd cycle National Exam (the first of the previously mentioned reform, prior to 1950) in the 1950-1959 folder, as to avoid confusion with the district level exams, since the transitional phase lasted until 1949.

Figure 13 shows the four-level structure of the website. In each terminal folder the corresponding exam listing can be found, in PDF format, with a total of around 900 exams. These exams are not attached to this thesis as the website www.examesfisicaquimica.org is available online.

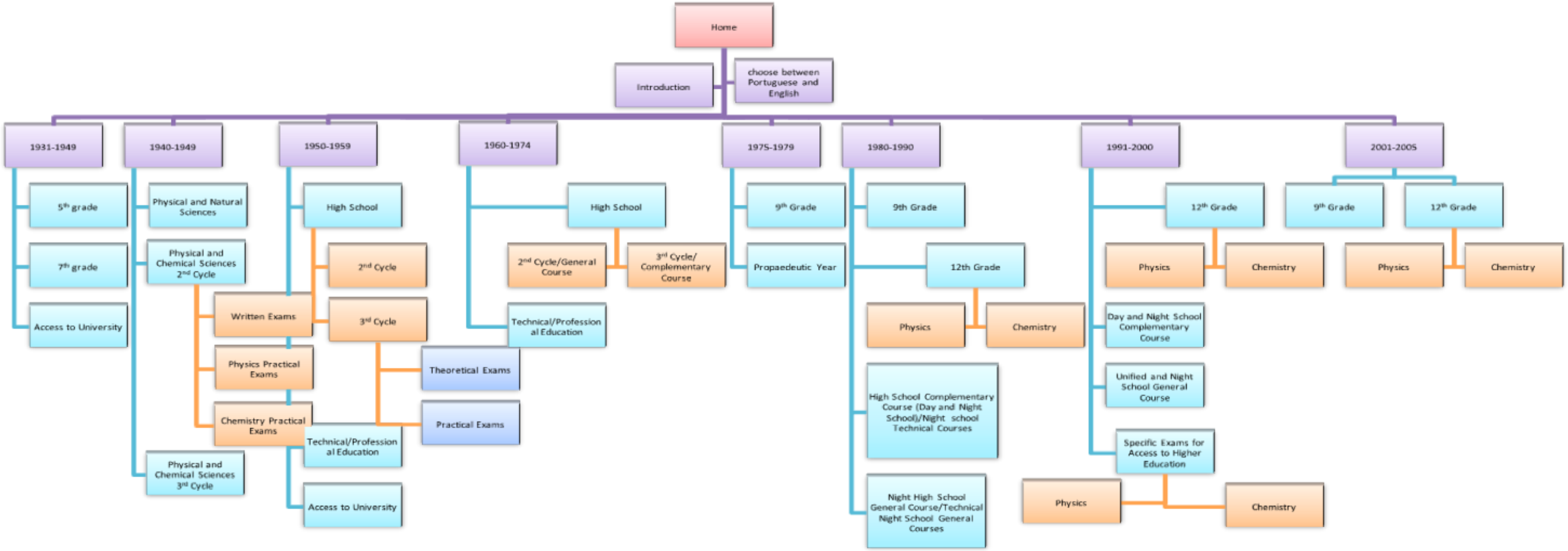

Figure 6.1. Website Structure

During the 1930s and 1940s the tests were answered on the question sheet. For this reason it was chosen to present the whole exam with security restrictions and without the identification of the author. Notes and commentaries (in Portuguese) were added to the exams as to make it easier for interested parties to find them. When it was not possible to show the original exams, the question sheets were transcribed from periodicals and magazines, citing the source. The majority of question sheets were scanned using optical character recognition (OCR) software to allow more functionality to the user. Some of the question sheets were damaged, making it necessary to use colour scanning to facilitate their viewing, leading to a slower download.

Building the website required the professional collaboration of designer Sónia Teixeira. The requirements were: an accessible website, with easy maintenance, which can be updated at any time.

Softpress Freeway 5.5 Pro, a visual web design application for the Macintosh, was used to build the website due to its simplicity and focus on design. The opening image shown is a composite of exams prior to the Reform of Pires de Lima. CSS was used on the layout of the website to define colours, styles, sizes, text and image position. The advantage of choosing CSS is that it allows for a short download time and simultaneously for the website to be easily updated.

In addition, a PHP script was added to indicate the user’s position in the website map wherever he or she may be, which makes the navigation effortless. PHP (recursive acronym for Hypertext Preprocessor) is a computer programming language commonly used to generate quick dynamic, simple and effective contents connected to databases. The programming of this language is done on the server side, i.e. a web server interprets it before it reaches the browser. This dynamic allows organizing, updating, and searching the exams more easily. In order for the website to update its contents, i.e. automatically create a new exam listing, one simply needs to update the information stored in the data bank. In short, the website is programmed to load the information of the digital archive every time it is accessed. On the other hand, PHP is freeware, its source code is freely available to all making it commonly used in such websites as Wikipedia.

The site is hosted on a European server for the next three years. However, the possibility of migrating to a national server is not put aside, if financial support is made available.

Appendix 2 – Multiple-choice Physics and Chemistry items from 2003 to 2005

Physics Exam 1st Phase, 1st call, 2003

P1 (3.) A steering wheel placed in a vertical plane spins, by action of two forces, around an horizontal axis that passes through its centre. (figure 1)

The angular velocity modulus w of the steering wheel, in function of time, is shown by the following equation $\omega = 4.0\ t$ (SI)

And the inertia momentum of the steering wheel in relation to the rotation axis is: I= 0.10 kg m^2.

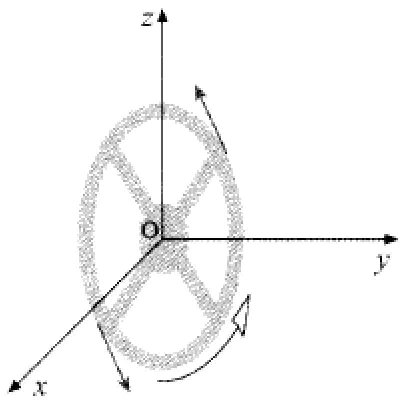

Fig. 1

What is the modulus of the binary momentum of forces applied to the steering wheel in function of time?

(A) 0.40t m N

(B) 0.40t kg m^2

(C) 0.40 m N

(D) 4.0t kg m^2

(E) 0.40 N m^{-1}

Correct answer: **(C)**

P2 (5.) Figure 3 represents a zone of the Earth's surface were it is possible to ignore its curvature and where the gravitational field associated to it is approximately uniform.

A body with mass **m** moves in this gravitational field, in a vertical displacement Δh, between two equipotential surfaces.

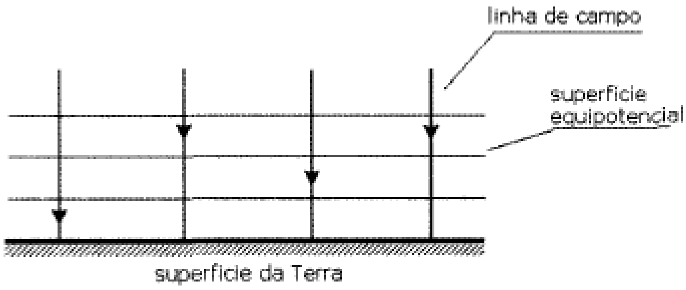

Fig. 3

The gravitational potential difference between those two surfaces is:

(A) $m\, g\, \Delta h$

(B) $g\, \Delta h$

(C) $\dfrac{\Delta h}{g}$

(D) $\dfrac{g}{\Delta h}$

(E) $g\, \dfrac{\Delta h}{m}$

Correct answer: **(B)**

Physics Exam 1st phase, 2004

P3 (5.) Figure 3 represents two wheels R_1 and R_2 with the same mass (distributed uniformly on their rims). The radius R_2, is smaller than radius R_1. Assume they spin with no attrition around their axles, with the same angular velocity, and that the mass of the spokes is negligible.

Constant tangential forces slow each wheel down until they stop. These forces have the same intensity F.

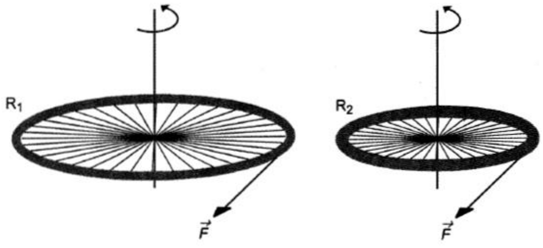

Fig. 3

In these conditions, which of the following statements is correct?

(A) The momentum of each force, in relation to the centre of rotation, is the same in both wheels.

(B) Both wheels have the same momentum of inertia.

(C) The momentum of inertia of wheel R_1 is lower than the momentum of inertia of wheel R_2.

(D) Both wheels stopped after the same time had elapsed.

(E) Wheel R_1 takes longer to stop.

Correct answer: **(E)**

P4 (()) A satellite of the Earth has a uniform circular motion at altitude H. What is the acceleration the satellite is subjected to along its trajectory?

(A) Tangential, with value $G\frac{m_T}{h^2}$

(B) Centripetal, with value $G\frac{m_T}{(r_T+h)^2}$

(C) Tangential, with value $G\frac{m_T}{r_T+h}$

(D) Centripetal, with value $G\frac{m_T\,m_S}{(r_T+h)^2}$

(E) Tangential, with value $G\frac{m_S}{(r_T+h)^2}$

With G – universal constant of gravitation

m_T – mass of the Earth

m_s – mass of the satellite

r_T – radius of the Earth

Correct answer: **(D)**

Physics Exam 1st phase, 2005

P5 (4.) Two spheres of equal mass *m* and negligible dimension are connected by a thin rigid rod of length *l*. The mass of the rod is also negligible. The ensemble spins with a constant angular velocity, with modulus ω, around the vertical axis (figure 1) passing through the midpoint *O* of the rod perpendicular to it.

It spins counter-clockwise when observed from above.

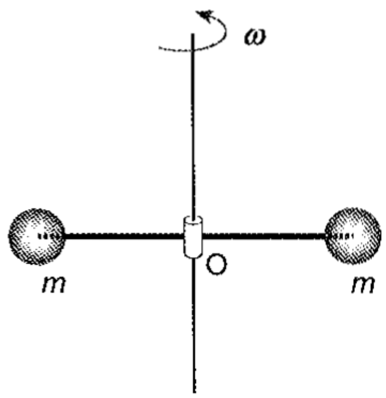

Fig. 1

The angular momentum of the two spheres in relation to point *O* is a vector:

(A) vertical, pointing down, with modulus $\frac{1}{2} m l^2 \omega$

(B) vertical, pointing up, with modulus $\frac{1}{4} m l^2 \omega$

(C) vertical, pointing down, with modulus $2\ m l^2 \omega$

(D) vertical, pointing up, with modulus $\frac{1}{2} m l^2 \omega$

(E) vertical, pointing down, with modulus $\frac{1}{4} m l^2 \omega$

Correct answer: **(D)**

P6 (5.) Consider the gravitational field created by a punctual charge *m* and consider two points, A and B, in that field (figure 2).

Assume that the gravitational potential created by any mass is null at infinity ($r = \infty$).

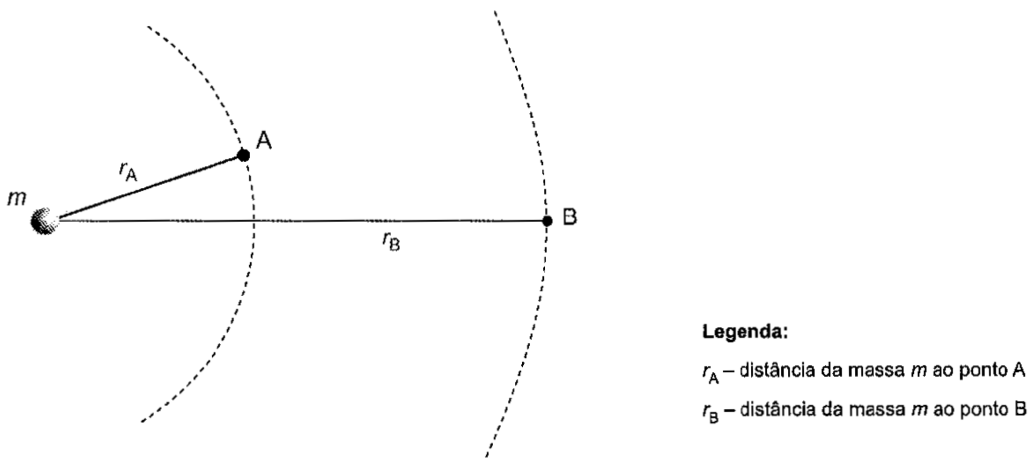

Fig. 2

Legend:

r_A – distance between mass *m* and point A

r_B – distance between mass *m* and point B

What is the difference in gravitational potential $V_B - V_A$, between those two points?

(A) $G\,m\left(\frac{1}{r_A^2} - \frac{1}{r_B^2}\right)$

(B) $G\,m\left(\frac{1}{r_B} - \frac{1}{r_A}\right)$

(C) $-\,G\,m\left(\frac{1}{r_A - r_B}\right)$

(D) $G\,m\left(\frac{1}{r_A} - \frac{1}{r_B}\right)$

(E) $G\,m\left(\frac{1}{r_B^2} - \frac{1}{r_A^2}\right)$

Correct answer: **(D)**

Chemistry Exam 1st phase, 1st call, 2003

C1 (4.) A container with a fixed capacity contains a mix of 11.0 g of carbon dioxide, $CO_2(g)$, and 7.00 g of nitrogen, $N_2(g)$, at a pressure of 1.0 atm.

8.00 g of oxygen, $O_2(g)$, are added with no change in temperature.

Assuming that there is no chemical reaction between the three gases at the given temperature, select the true statement.

(A) The mole fraction of carbon dioxide in the final mix is $\frac{11}{26}$.

(B) By adding oxygen, the partial pressure of nitrogen decreases.

(C) The final total pressure of the mix is 1.5 atm.

(D) In the initial mix the partial pressure of nitrogen is lower than the partial pressure of carbon dioxide.

(E) In the final mix, the gas found in the least quantity (expressed in mol) is nitrogen.

$\boldsymbol{M(N_2) = 28.0\ g\ mol^{-1}}$

$\boldsymbol{M(O_2) = 32.0\ g\ mol^{-1}}$

$\boldsymbol{M(CO_2) = 44.0\ g\ mol^{-1}}$

Correct answer: **(C)**

C2 (()) For the most part, chemical reactions are accompanied by variation in energy and entropy.

These variations depend on the reaction system and on the conditions it is subject to.

Select the true statement.

(A) In any chemical reaction in a closed system, the system entropy increases.

(B) In any chemical reaction in an isolated system, the temperature is constant.

(C) In a closed system, an endothermic reaction can only be spontaneous if the entropy of the exterior increases.

(D) In an isolated system, when a chemical reaction reaches chemical balance, the entropy of the system stays constant.

(E) Exothermic reactions always cause the reduction of the entropy of the system where they occur.

Correct answer:**(D)**

Chemistry Exam 1st phase, 2004

C3 (3.) The boiling temperatures at normal pressure (1 atm) of some chemical compounds formed by hydrogen and elements of groups 16 or 17 of the Periodic Table are represented in the graph in figure 1.

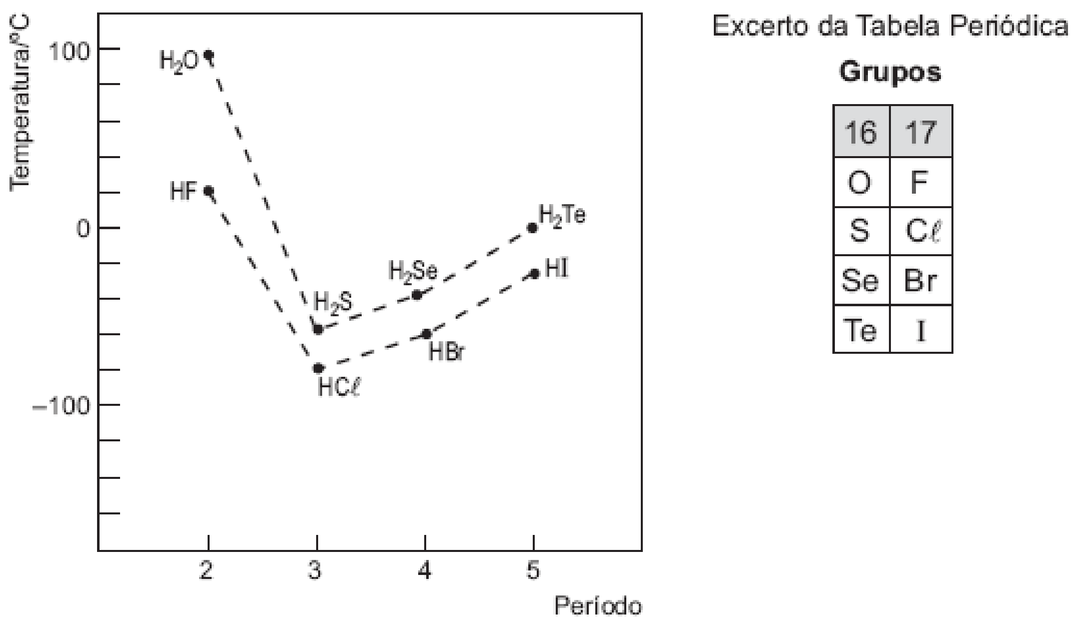

Fig. 1

Legend: Temperature, Period Excerpt from the Periodic Table, Groups.

Consider the following statements about some of the properties of the compounds mentioned in figure 1.

Select the true statement.

(A) Amongst the compounds mentioned in the graphic, water (H_2O) is the substance that presents the highest volatility.

(B) The H_2O and HF compounds have much higher boiling temperatures than the other compounds due to the existence of very intense London dispersion forces between their molecules.

(C) The increase in boiling temperature in the HCl, HBr, and HI sequence is due to the variation of the permanent dipole of the respective molecules.

(D) The difference between the boiling points of H_2O and HF is due to the difference in the electronegativity values presented by the oxygen and fluorine atoms.

(E) At a pressure of 1 atm and at a temperature of 25 ºC, not all the mentioned compounds present themselves in liquid state.

Correct answer: **(E)**

C4 (()) Chemical reactions are, generally, accompanied by variation of the internal energy (U) and entropy (S). Select the true statement.

(A) An exoenergetic reaction is always exothermic.

(B) When there is a transformation in an isolated system, $\Delta S< 0$.

(C) In an isolated system there is no temperature variation due to chemical transformations.

(D) In a closed system, the temperature increases due to an exothermic reaction is accompanied by a decrease in external temperature.

(E) An endothermic reaction happening in a closed system with a decrease in volume presents $\Delta U> 0$.

Correct answer: **(E)**

Chemistry Exam 1st phase, 2005

C5 (2.) Regarding the behaviour of ideal gases, select the true statement.

(A) For any ideal gas, the value of the constant (R) in the equation $PV = nRT$, does not depend of the units of pressure (P) or volume (V).

(B) Keeping the volume constant, the pressure of a sample of an ideal gas is directly proportional to the temperature in Celsius.

(C) Keeping the temperature constant, the volume of a sample of ideal gas is directly proportional to the gas quantity (*n*) in the sample, whatever the pressure of the gas may be.

(D) Keeping the pressure and temperature constant, the volume of a sample of ideal gas is directly proportional to the gas quantity (*n*) in the sample.

(E) At the pressure of 1 atm, the volume occupied by 1 mol of any ideal gas is 22.4 dm^3, independently of the temperature of the sample.

Correct answer: **(D)**

C6 (()) Nitrogen monoxide (NO(g)) can be transformed into nitrogen dioxide (NO_2(g)) according to the following chemical equation:

$$2\ NO(g) + O_2(g) \leftrightarrows 2\ NO_2(g) \qquad \Delta H = -113\ kJ$$

Considering the reaction at normal temperature and pressure, in a closed recipient with variable capacity, select the correct statement.

(A) During the reaction there is no work produced.

(B) For each mole of NO_2(g) formed the reaction system absorbs 113 kJ in the form of heat.

(C) During the reaction the external entropy decreases.

(D) During the reaction the entropy of the reaction system increases.

(E) For each mole of NO(g) used, 56.5 kJ are released as heat.

Correct answer: **(E)**

Appendix 3 – Data Tables of Standard Setting Methods

A. Contrasting Groups Method

In the operation of the Contrasting Groups Method, the exam grades were distributed by 10 intervals related to a reference grade (table 4.9), expected for the 2004 and 2005 exams. For these two years there was a high number of examinees and the exam grades (0 to 200 points) were divided into 21 intervals related to a reference grade between 0 and 20. The criteria used for the grouping of exam grades in an interval is identical to the one used to round grades to the unit when transposing grades from a 0 to 200 points scale to a 0 to 20 scale.

Physics-Chemistry – 2nd cycle

Table 6.2. Frequency table of exams grades of Physics-Chemistry – 2nd cycle from 1950 to 1956.

	School year									
Reference Grade	**1949/1950**		**1950/1951**		**1952/1953**		**1953/1954**		**1955/1956**	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
2	3	2	14	1	14	0	7	0	4	3
4	6	0	43	2	30	0	37	0	8	0
6	18	5	55	8	39	1	35	0	12	1
8	28	5	68	5	41	2	62	5	13	1
10	25	13	47	13	53	4	66	8	95	2
12	24	15	24	17	52	22	58	22	43	7
14	14	20	18	21	33	11	48	26	81	17
16	12	15	4	16	15	22	23	22	31	27
18	8	24	1	9	2	16	6	17	17	31
20	0	4	1	0	0	1	1	3	1	9

Table 6.3. Frequency table of exams grades of Physics-Chemistry – 2nd cycle from 1960 to 1967.

Reference Grade	School year 1959/1960 Group A	Group B	1964/1965 Group A	Group B	1966/1967 Group A	Group B
2	5	0	34	0	53	0
4	18	0	89	0	140	0
6	32	0	113	2	151	5
8	36	3	118	11	154	29
10	43	4	122	38	136	88
12	43	16	93	48	78	74
14	45	33	78	53	34	69
16	22	40	45	40	26	51
18	12	43	26	24	6	11
20	5	11	6	8	1	2

Table 6.4. Frequency table of exams grades of Physics-Chemistry – 2nd cycle from 1970 to 1973

Reference Grade	School year 1969/1970 Group A	Group B	1971/1972 Group A	Group B	1972/1973 Group A	Group B
2	6	5	3	0	2	0
4	27	3	5	0	11	0
6	35	3	14	0	8	0
8	42	19	12	0	7	3
10	64	39	23	6	10	7
12	64	70	27	10	9	22
14	47	66	19	30	1	33
16	22	40	8	36	5	24
18	6	20	2	23	1	7
20	0	2	3	5	0	0

Physics-Chemistry – 3rd cycle

Table 6.5. Frequency table of exams grades of Physics-Chemistry – 3rd cycle from 1949 to 1956.

Reference Grade	School year								
	1948/1949		1953/1954		1954/1955		1955/1956		
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B	
								B1	B2
2	6	0	1	0	0	4	1	1	0
4	4	0	0	0	7	2	2	1	0
6	16	2	1	0	2	3	6	2	0
8	17	4	10	1	5	5	6	4	1
10	19	4	5	3	6	9	7	8	3
12	24	10	19	19	3	5	5	5	4
14	26	26	10	12	4	7	1	7	13
16	14	27	4	5	2	10	2	8	9
18	1	14	0	6	0	11	1	5	6
20	1	5	0	0	1	6	0	0	1

Table 6.6. Frequency table of exams grades of Physics-Chemistry – 3rd cycle from 1959 to 1964.

Reference Grade	School year								
	1958/1959		1959/1960			1960/1961		1963/1964	
	Group A	Group B	Group A	Group B		Group A	Group B	Group A	Group B
				B1	B2				
2	5	0	3	0	0	9	0	24	0
4	14	1	16	1	0	28	1	56	1
6	11	4	17	0	0	37	3	41	6
8	15	11	24	1	1	18	20	29	13
10	17	12	17	2	0	18	26	22	21
12	16	12	16	6	2	9	24	18	22
14	4	5	7	7	8	2	11	6	18
16	1	2	3	2	8	0	6	2	5
18	2	2	0	2	10	0	4	1	5
20	0	0	0	0	2	0	0	0	0

Table 6.7. Frequency table of exams grades of Physics-Chemistry – 3rd cycle from 1965 to 1969.

Reference Grade	School year							
	1964/1965			1965/1966		1968/1969		
	Group A	Group B		Group A	Group B	Group A	Group B	
		B1	B2				B1	B2
2	33	3	1	31	2	6	0	0
4	47	3	0	65	3	23	1	0
6	42	5	2	68	2	44	6	3
8	41	8	5	60	12	27	17	7
10	37	12	8	58	23	20	20	5
12	28	24	11	42	27	7	22	7
14	16	37	20	21	26	2	12	10
16	4	11	18	16	55	0	4	8
18	2	8	10	2	24	2	1	5
20	1	2	5	0	12	0	0	0

Table 6.8. Frequency table of exams grades of Physics-Chemistry – 3rd cycle from 1969 to 1973.

Reference Grade	School year								
	1969/1970		1970/1971		1971/1972			1972/1973	
	Group A	Group B	Group A	Group B	Group A	Group B		Group A	Group B
						B1	B2		
2	24	1	19	0	19	1	0	12	0
4	39	4	36	10	52	1	0	31	1
6	41	6	44	30	58	5	1	28	6
8	27	14	24	55	32	13	3	16	22
10	20	30	21	44	20	12	1	12	11
12	10	19	8	29	10	12	1	9	17
14	5	33	3	19	4	6	0	4	5
16	3	12	5	13	1	0	0	2	1
18	0	4	2	2	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0

Physics 12th Grade

Table 6.9. Frequency table of exams grades of Physics 12th grade from 1982 to 1984.

Reference Grade	1981/1982			1982/1983			1983/1984		
	Group A	Group B		Group A	Group B		Group A	Group B	
		Bl	B2		B1	B2		B1	B2
2	1	2	0	11	3	3	16	0	0
4	7	8	2	11	8	2	10	7	1
6	14	15	13	10	9	5	8	7	3
8	5	27	24	8	9	8	6	15	15
10	1	29	32	6	13	17	3	10	14
12	0	24	43	3	8	11	3	3	16
14	0	10	52	0	2	12	1	1	19
16	0	8	35	0	1	25	1	0	10
18	0	1	18	0	1	8	0	0	6
20	0	1	4	0	0	2	0	0	2

Table 6.10. Frequency table of exams grades of Physics 12th grade from 1984 to 1989.

Reference Grade	School year									
	1984/1985		1985/1986		1986/1987		1987/1988		1988/1989	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
2	8	6	4	1	10	3	10	0	5	1
4	4	15	2	4	5	7	1	2	2	1
6	9	10	2	3	8	9	1	1	2	3
8	7	19	1	13	6	16	0	1	3	1
10	2	22	8	17	1	11	0	8	4	6
12	1	22	2	15	0	19	1	5	2	7
14	2	15	4	11	0	10	2	7	2	9
16	0	12	2	15	1	5	0	18	0	12
18	0	9	2	5	0	5	0	10	0	8
20	0	1	0	2	0	0	0	9	0	5

Table 6.11. Frequency table of exams grades of Physics 12th grade from 1990 to 1994.

Reference Grade	**School year**									
	1989/1990		**1990/1991**		**1991/1992**		**1992/1993**		**1993/1994**	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
2	7	0	3	2	2	1	2	2	5	2
4	9	6	5	7	5	5	3	0	4	5
6	6	4	7	5	7	6	2	3	8	4
8	1	4	5	9	9	7	7	7	4	9
10	2	5	3	13	5	9	5	6	2	9
12	2	16	2	19	3	14	6	9	5	10
14	1	26	1	15	1	12	1	11	2	10
16	1	12	1	9	2	9	2	5	1	8
18	2	17	0	7	0	12	0	6	0	6
20	1	2	0	1	0	3	0	0	0	0

Table 6.12. Frequency table of exams grades of Physics 12th grade from 1995 to 1999.

Reference Grade	**School year**									
	1994/1995		**1995/1996**		**1996/1997**		**1997/1998**		**1998/1999**	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
2	2	1	9	5	8	0	1	0	5	0
4	3	4	5	5	5	2	6	2	10	2
6	4	6	2	2	0	6	3	3	13	3
8	2	5	5	2	2	9	0	2	4	2
10	3	10	2	5	1	8	2	2	1	4
12	1	7	1	5	0	6	0	3	0	5
14	0	8	0	5	0	10	0	7	0	4
16	0	6	0	3	0	7	1	2	0	1
18	0	3	0	1	0	4	2	5	0	0
20	0	1	0	0	0	2	1	1	0	0

Table 6.13. Frequency table of exams grades of Physics 12th grade from 2000 to 2002.

Reference Grade	**1999/2000**			**2000/2001**			**2001/2002**		
	Group A	Group B		Group A	Group B		Group A	Group B	
		Bl	B2		B1	B2		B1	B2
2	5	0	0	2	2	0	7	2	0
4	8	2	0	10	4	0	11	1	2
6	8	5	0	6	7	0	8	7	0
8	5	8	2	7	10	1	2	6	2
10	2	8	0	8	13	3	7	6	0
12	3	7	4	3	8	5	4	19	4
14	2	8	7	3	8	5	1	17	4
16	0	4	6	2	6	6	3	11	6
18	0	1	7	1	2	10	1	4	7
20	0	0	4	0	1	10	0	1	12

Table 6.14. Frequency table of exams grades of Physics 12th grade from 2002/2003.

Reference Grade	**2002/2003**		
	Group A	Group B	
		Bl	B2
2	30	8	0
4	22	22	2
6	18	36	3
8	15	35	7
10	9	32	14
12	5	14	31
14	5	8	26
16	0	0	17
18	0	0	12
20	0	0	8

Table 6.15. Frequency table of exams grades of Physics 12th grade from 2004 to 2005.

Reference Grade	**2003/2004**			**2004/2005**		
	Group A	Group B		Group A	Group B	
		B1	B2		B1	B2
0	11	10	0	12	2	0
1	82	19	1	35	6	0
2	176	60	5	95	32	2
3	225	138	9	124	77	7
4	212	225	16	154	121	17
5	187	286	16	147	215	16
6	132	389	26	142	275	25
7	117	439	46	130	396	29
8	99	528	77	127	445	36
9	89	511	97	105	457	66
10	91	613	130	89	548	102
11	77	510	179	84	589	118
12	75	444	217	86	543	148
13	52	355	245	59	460	210
14	52	272	271	70	405	238
15	53	179	332	55	292	283
16	33	130	311	38	218	321
17	22	64	297	29	136	340
18	22	34	232	22	79	320
19	10	9	198	17	21	228
20	5	1	89	10	8	134

Chemistry – 12th Grade

Table 6.16. Frequency table of exams grades of Chemistry12th grade from 1982 to 1984.

Reference Grade	1981/1982			1982/1983			1983/1984		
	Group A	Group B		Group A	Group B		Group A	Group B	
		B1	B2		B1	B2		B1	B2
2	4	2	0	6	0	0	1	1	0
4	3	9	5	8	16	1	6	2	1
6	2	16	11	14	24	5	3	12	4
8	3	24	23	7	32	14	9	13	10
10	3	16	27	4	23	27	2	14	14
12	1	12	47	1	14	29	1	10	16
14	1	2	43	0	1	26	1	2	10
16	1	0	36	0	0	9	1	0	14
18	0	1	30	0	0	5	0	0	4
20	0	0	21	0	0	1	0	0	2

Table 6.17. Frequency table of exams grades of Chemistry12th grade from 1985 to 1989.

Reference Grade	School year									
	1984/1985		1985/1986		1986/1987		1987/1988		1988/1989	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
2	4	0	2	0	4	0	2	2	2	0
4	3	5	7	2	5	0	3	1	1	4
6	8	7	6	3	10	6	3	2	3	9
8	6	12	8	17	13	12	6	11	5	9
10	2	20	10	20	4	15	1	8	4	14
12	8	27	11	25	2	9	2	15	4	12
14	5	20	12	27	0	4	2	15	3	9
16	11	16	3	20	0	4	0	19	2	10
18	2	3	0	7	0	1	0	19	0	6
20	0	0	0	0	0	0	0	4	0	0

Table 6.18. Frequency table of exams grades of Chemistry12th grade from 1990 to 1994.

Reference Grade	School year 1989/1990 Group A	Group B	1990/1991 Group A	Group B	1991/1992 Group A	Group B	1992/1993 Group A	Group B	1993/1994 Group A	Group B
2	4	1	3	0	1	0	4	0	1	0
4	3	3	2	1	3	1	5	3	2	1
6	5	2	4	2	4	2	3	5	5	3
8	8	5	5	6	5	3	6	9	3	4
10	10	7	4	7	4	6	8	10	5	6
12	8	9	7	7	1	5	3	9	3	7
14	3	6	5	8	0	5	1	8	1	5
16	1	2	3	1	0	2	0	5	0	4
18	2	2	0	2	0	2	0	3	0	2
20	0	0	0	0	0	0	0	0	0	1

Table 6.19. Frequency table of exams grades of Chemistry12th grade from 1995 to 1999.

Reference Grade	School year 1994/1995 Group A	Group B	1995/1996 Group A	Group B	1996/1997 Group A	Group B	1997/1998 Group A	Group B	1998/1999 Group A	Group B
2	1	0	9	5	0	0	0	0	0	0
4	3	2	4	6	1	0	0	0	2	0
6	5	5	2	3	2	0	6	0	4	0
8	4	7	2	4	6	0	12	6	10	5
10	6	6	2	6	1	0	7	8	12	6
12	3	8	1	3	1	2	3	10	4	4
14	2	8	0	4	8	2	2	22	3	7
16	0	4	1	1	9	1	1	13	1	5
18	0	1	1	0	6	6	1	16	2	5
20	0	0	0	0	6	1	2	13	2	3

Table 6.20. Frequency table of exams grades of Chemistry12th grade from 2000 to 2002.

Reference Grade	**1999/2000**			**2000/2001**			**2001/2002**		
	Group A	Group B		Group A	Group B		Group A	Group B	
		Bl	B2		B1	B2		B1	B2
2	0	0	0	1	0	0	5	0	0
4	4	0	0	4	2	0	4	0	0
6	5	9	1	2	2	0	4	7	0
8	4	13	1	4	3	0	12	9	1
10	2	6	2	1	12	1	11	17	3
12	1	12	10	5	7	2	5	15	2
14	1	12	12	2	4	4	9	10	6
16	1	1	9	2	5	4	4	1	7
18	1	0	3	4	3	10	8	1	14
20	4	0	4	6	0	8	9	0	9

Table 6.21. Frequency table of exams grades of Chemistry12th grade 2002/2003.

Reference Grade	**2002/2003**		
	Group A	Group B	
		Bl	B2
2	3	0	0
4	11	0	0
6	17	5	0
8	10	17	3
10	10	27	9
12	14	30	14
14	10	18	16
16	13	7	36
18	9	0	17
20	25	0	24

Table 6.22. Frequency table of exams grades of Chemistry12th grade from 2004 to 2005.

Reference Grade	**2003/2004**			**2004/2005**		
	Group A	Group B		Group A	Group B	
		B1	B2		B1	B2
0	9	20	6	11	4	0
1	32	31	5	17	6	0
2	112	52	11	98	48	2
3	180	210	19	142	169	7
4	227	444	29	182	357	10
5	243	794	78	184	630	35
6	256	1058	149	208	849	57
7	229	1285	222	205	1040	97
8	255	1331	331	169	1117	164
9	250	1241	500	187	1111	219
10	227	959	659	162	1127	283
11	181	694	661	134	1008	392
12	169	422	722	147	818	525
13	129	216	728	135	654	613
14	132	129	677	136	538	697
15	128	80	649	176	367	810
16	148	35	587	179	202	858
17	156	13	545	212	114	930
18	217	2	492	303	44	897
19	229	2	430	426	15	863
20	280	0	402	399	3	644

B. Beuk Method

The teacher's answers for each question (QA and QB), total average, standard deviation, ratio of these standard deviations (stdQA/stdQB) and slope of a line equal to this ratio are presented in the following tables for the Group I, Group II and Group III exams.

Group I – Physics-Chemistry exams of 1956, 1960, 1965, 1969 and 1972.

Table 6.23. Results from teacher's answers for each question (QA and QB), total average, standard deviation, ratio of these standard deviations (stdQA/stdQB) and slope of a line equal to this ratio are presented for the Group I

	1956 Exam							
Teacher	QA	QB	$\overline{A}$	stdQA	$\overline{B}$	stdQB	stdQA/stdQB	slope
1	.75	.75	.55	.0797	.63	.0497	1.60	58º
2	.50	.60						
3	.55	.65						
4	.50	.65						
5	.60	.62						
6	.50	.65						
7	.50	.57						
8	.60	.65						
9	.50	.60						
10	.55	.60						
	1960 Exam							
Teacher	QA	QB	$\overline{A}$	stdQA	$\overline{B}$	stdQB	stdQA/stdQB	slope
1	.65	.60	.54	.0516	.63	.0258	2.00	63º
2	.50	.60						
3	.55	.65						
4	.50	.60						
5	.55	.65						
6	.50	.65						
7	.50	.65						
8	.55	.65						
9	.50	.60						
10	.60	.65						
	1965 Exam							
Teacher	QA	QB	$\overline{A}$	stdQA	$\overline{B}$	stdQB	stdQA/stdQB	slope
1	.48	.50	.53	.0672	.59	.0662	1.02	45º
2	.50	.52						
3	.45	.60						
4	.50	.65						
5	.60	.65						
6	.50	.55						
7	.55	.68						
8	.50	.55						
9	.55	.60						
10	.68	.65						

	1969 Exam							
Teacher	QA	QB	$\overline{A}$	stdQA	$\overline{B}$	stdQB	stdQA/stdQB	slope
1	.55	.62	.52	.0363	.60	.0445	.82	39º
2	.50	.55						
3	.50	.60						
4	.55	.65						
5	.60	.65						
6	.50	.55						
7	.50	.55						
8	.50	.60						
9	.50	.55						
10	.50	.65						
	1972 Exam							
Teacher	QA	QB	$\overline{A}$	stdQA	$\overline{B}$	stdQB	stdQA/stdQB	slope
1	.50	.62	.52	.0242	.59	.0496	.49	26º
2	.50	.57						
3	.55	.68						
4	.50	.58						
5	.55	.53						
6	.50	.56						
7	.50	.57						
8	.50	.66						
9	.50	.61						
10	.55	.54						

Group II – Physics and Chemistry exams of 1982, 1983 and 1984

Table 6.24. Results from teacher's answers for each question (QA and QB), total average, standard deviation, ratio of these standard deviations (stdQA/stdQB) and slope of a line equal to this ratio are presented for Group II – Physics.

	1982 Physics Exam							
Teacher	QA	QB	$\overline{A}$	stdQA	$\overline{B}$	stdQB	stdQA/stdQB	slope
1	.40	.60	.48	.0334	.61	.0333	0.78	38º
2	.50	.65						
3	.48	.55						
4	.50	.65						
5	.50	.65						
6	.48	.60						
7	.50	.60						
8	.45	.60						
9	.50	.60						
10	.45	.55						

	1983 Physics Exam							
Teacher	QA	QB	$\overline{A}$	stdQA	$\overline{B}$	stdQB	stdQA/stdQB	slope
1	.45	.55	.49	.0242	.60	.0369	0.815	39º
2	.50	.60						
3	.50	.65						
4	.45	.60						
5	.50	.65						
6	.45	.55						
7	.50	.60						
8	.50	.55						
9	.50	.60						
10	.50	.60						

	1984 Physics Exam							
Teacher	QA	QB	$\overline{A}$	stdQA	$\overline{B}$	stdQB	stdQA/stdQB	slope
1	.50	.55	.49	.0211	.59	.0427	0.832	39º
2	.50	.55						
3	.50	.60						
4	.50	.60						
5	.45	.55						
6	.50	.65						
7	.50	.60						
8	.50	.65						
9	.50	.60						
10	.45	.55						

Table 6.25. Results from teacher's answers for each question (QA and QB), total average, standard deviation, ratio of these standard deviations (stdQA/stdQB) and slope of a line equal to this ratio are presented for Group II – Chemistry.

	1982 Chemistry Exam							
Teacher	QA	QB	$\overline{A}$	stdQA	$\overline{B}$	stdQB	stdQA/stdQB	slope
1	.50	.60	.49	.0242	.58	.0483	0.50	27º
2	.50	.50						
3	.45	.60						
4	.50	.65						
5	.45	.55						
6	.50	.55						
7	.50	.60						
8	.50	.55						
9	.50	.65						
10	.45	.55						

	1983 Chemistry Exam							
Teacher	QA	QB	$\overline{A}$	stdQA	$\overline{B}$	stdQB	stdQA/stdQB	slope
1	.45	.55	.47	.0258	.57	.0242	1.07	47º
2	.50	.55						
3	.45	.55						
4	.45	.60						
5	.50	.60						
6	.50	.55						
7	.45	.60						
8	.45	.55						
9	.50	.55						
10	.45	.55						

	1984 Chemistry Exam							
Teacher	QA	QB	$\overline{A}$	stdQA	$\overline{B}$	stdQB	stdQA/stdQB	slope
1	.50	.60	.49	.0211	.59	.0316	0.67	34º
2	.50	.60						
3	.45	.55						
4	.50	.60						
5	.50	.60						
6	.50	.55						
7	.50	.60						
8	.50	.60						
9	.50	.65						
10	.45	.55						

Group III – Physics and Chemistry exams of 2004 and 2005;

Table 6.26. Results from teacher's answers for each question (QA and QB), total average, standard deviation, ratio of these standard deviations (stdQA/stdQB) and slope of a line equal to this ratio are presented for Group III - Physics.

	2004 Physics Exam							
Teacher	QA	QB	$\overline{A}$	stdQA	$\overline{B}$	stdQB	stdQA/stdQB	slope
1	.48	.65	.48	.0175	.61	.0552	0.317	17º
2	.48	.63						
3	.48	.66						
4	.48	.53						
5	.46	.58						
6	.48	.58						
7	.46	.54						
8	.52	.66						
9	.50	.68						
10	.48	.56						

	2005 Physics Exam							
Teacher	QA	QB	$\overline{A}$	stdQA	$\overline{B}$	stdQB	stdQA/stdQB	slope
1	.45	.52	.48	.0341	.56	.0396	0.863	41º
2	.50	.58						
3	.50	.62						
4	.48	.50						
5	.40	.60						
6	.50	.56						
7	.48	.52						
8	.48	.55						
9	.50	.56						
10	.52	.60						

Table 6.27. Results from teacher's answers for each question (QA and QB), total average, standard deviation, ratio of these standard deviations (stdQA/stdQB) and slope of a line equal to this ratio are presented for Group III - Chemistry.

	2004 Chemistry Exam							
Teacher	QA	QB	$\overline{A}$	stdQA	$\overline{B}$	stdQB	stdQA/stdQB	slope
1	.50	.60	.49	.0282	.56	.0401	0.70	35º
2	.52	.57						
3	.48	.55						
4	.50	.58						
5	.54	.62						
6	.50	.56						
7	.45	.50						
8	.48	.52						
9	.50	.56						
10	.45	.50						

	2005 Chemistry Exam							
Teacher	QA	QB	$\overline{A}$	stdQA	$\overline{B}$	stdQB	stdQA/stdQB	slope
1	.55	.58	.51	.0383	.58	.0362	1.058	6º
2	.50	.55						
3	.54	.60						
4	.52	.55						
5	.48	.52						
6	.56	.62						
7	.54	.64						
8	.50	.60						
9	.45	.56						
10	.46	.58						

Group I – Physics-Chemistry exams of 1956, 1960, 1965, 1969 and 1972.

In following tables SN is the student's number; EG is the Exam Grade – representing the cut scores and PR is the passing rate.

Table 6.28. Frequency table of EG and PR of Physics-Chemistry – 3rd cycle from 1956.

SN	EG	PR	SN	EC	PR	SN	EC	PR
1	0.95	0.10	21	0.55	0.73	41	0.45	0.87
2	0.55	0.73	22	0.40	0.95	42	0.70	0.53
3	0.85	0.27	23	0.65	0.63	43	0.75	0.44
4	0.30	0.98	24	0.70	0.53	44	0.90	0.20
5	0.75	0.44	25	0.70	0.53	45	0.90	0.20
6	0.75	0.44	26	0.45	0.87	46	0.70	0.53
7	0.95	0.10	27	0.55	0.73	47	0.55	0.73
8	0.75	0.44	28	0.40	0.95	48	0.65	0.63
9	0.35	0.98	29	0.95	0.10	49	1.00	0.03
10	0.25	1.00	30	0.85	0.27	50	0.90	0.20
11	0.55	0.73	31	0.95	0.10	51	0.80	0.31
12	0.75	0.44	32	0.45	0.87	52	0.40	0.95
13	0.90	0.20	33	0.75	0.44	53	0.50	0.80
14	0.40	0.95	34	0.35	0.98	54	0.80	0.31
15	0.75	0.44	35	0.65	0.63	55	0.75	0.44
16	1.00	0.03	36	0.40	0.95	56	0.45	0.87
17	0.50	0.80	37	0.65	0.63	57	0.50	0.80
18	0.90	0.20	38	0.65	0.63	58	0.90	0.20
19	0.65	0.63	39	0.50	0.80	59	0.85	0.27
20	0.70	0.53	40	0.85	0.27	60	0.55	0.73

Table 6.29. Frequency table of EG and PR of Physics-Chemistry – 3rd cycle from 1960.

SN	EG	PR	SN	EG	PR	SN	EG	PR
1	0.83	0.22	18	0.82	0.27	35	0.89	0.10
2	0.88	0.12	19	0.68	0.57	36	0.50	0.96
3	0.68	0.57	20	0.83	0.24	37	0.78	0.37
4	0.63	0.75	21	0.69	0.51	38	0.77	0.41
5	0.67	0.63	22	0.55	0.86	39	0.78	0.37
6	0.90	0.06	23	0.53	0.90	40	0.65	0.69
7	0.89	0.08	24	0.92	0.04	41	0.67	0.61
8	0.40	1.00	25	0.76	0.45	42	0.80	0.31
9	0.47	0.98	26	0.88	0.14	43	0.69	0.51
10	0.68	0.57	27	0.87	0.16	44	0.58	0.82
11	0.64	0.71	28	0.55	0.84	45	0.85	0.20
12	0.78	0.33	29	0.59	0.80	46	0.74	0.47
13	0.62	0.76	30	0.59	0.78	47	0.86	0.18
14	0.77	0.39	31	0.80	0.31	48	0.66	0.67
15	0.67	0.61	32	0.53	0.88	49	0.99	0.02
16	0.82	0.27	33	0.66	0.67	50	0.51	0.92
17	0.63	0.75	34	0.76	0.45	51	0.50	0.96

Table 6.30. Frequency table of EG and PR of Physics-Chemistry – 3rd cycle from 1965.

SN	EG	PR	SN	EG	PR	SN	EG	PR
1	0.65	0.47	28	0.64	0.51	55	0.58	0.71
2	0.40	0.97	29	0.73	0.27	56	0.92	0.04
3	0.68	0.40	30	0.49	0.87	57	0.79	0.16
4	0.62	0.58	31	0.55	0.77	58	0.46	0.94
5	0.47	0.91	32	0.69	0.35	59	0.63	0.54
6	0.70	0.34	33	0.59	0.70	60	0.79	0.16
7	0.60	0.67	34	0.55	0.77	61	0.61	0.63
8	0.65	0.47	35	0.51	0.84	62	0.63	0.54
9	0.50	0.86	36	0.56	0.75	63	0.75	0.25
10	0.66	0.42	37	0.72	0.28	64	0.62	0.58
11	0.52	0.81	38	0.68	0.40	65	0.48	0.89
12	0.56	0.75	39	0.85	0.08	66	0.60	0.67
13	0.77	0.20	40	0.60	0.67	67	0.47	0.91
14	0.79	0.16	41	0.81	0.10	68	0.65	0.47
15	0.46	0.94	42	0.45	0.95	69	0.54	0.78
16	0.90	0.05	43	0.79	0.16	70	0.68	0.40
17	0.71	0.32	44	0.61	0.63	71	0.30	1.00
18	0.75	0.25	45	0.53	0.80	72	0.76	0.23
19	0.97	0.03	46	0.50	0.86	73	0.70	0.34
20	0.59	0.70	47	0.44	0.96	74	0.77	0.20
21	0.71	0.32	48	0.77	0.20	75	0.84	0.09
22	0.85	0.08	49	0.36	0.99	76	0.51	0.84
23	0.76	0.23	50	0.62	0.58	77	0.97	0.03
24	0.63	0.54	51	0.65	0.47	78	0.61	0.63
25	0.64	0.51	52	0.57	0.72	79	0.71	0.32
26	0.64	0.51	53	0.61	0.63			
27	0.79	0.16	54	0.68	0.40			

Table 6.31. Frequency table of EG and PR of Physics-Chemistry – 3rd cycle from 1969.

SN	EG	PR	SN	EG	PR	SN	EG	PR	SN	EG	PR
1	0.64	0.25	33	0.76	0.09	65	0.63	0.29	97	0.44	0.73
2	0.46	0.70	34	0.65	0.23	66	0.47	0.67	98	0.53	0.53
3	0.54	0.48	35	0.53	0.50	67	0.40	0.78	99	0.39	0.80
4	0.85	0.03	36	0.46	0.70	68	0.56	0.40	100	0.35	0.89
5	0.54	0.48	37	0.52	0.55	69	0.34	0.90	101	0.41	0.75
6	0.53	0.53	38	0.60	0.35	70	0.58	0.38	102	0.43	0.74
7	0.66	0.20	39	0.72	0.14	71	0.50	0.60	103	0.33	0.92
8	0.75	0.11	40	0.38	0.82	72	0.39	0.80	104	0.30	0.96
9	0.29	0.98	41	0.33	0.93	73	0.64	0.25	105	0.60	0.33
10	0.63	0.29	42	0.64	0.27	74	0.86	0.02	106	0.26	1.00
11	0.66	0.21	43	0.55	0.42	75	0.35	0.89	107	0.54	0.48
12	0.73	0.13	44	0.37	0.84	76	0.54	0.48	108	0.86	0.02
13	0.50	0.60	45	0.69	0.17	77	0.47	0.67	109	0.38	0.83
14	0.58	0.38	46	0.52	0.55	78	0.34	0.91	110	0.40	0.76
15	0.63	0.31	47	0.60	0.35	79	0.26	1.00	111	0.37	0.84
16	0.65	0.22	48	0.40	0.76	80	0.29	0.98	112	0.46	0.71
17	0.34	0.90	49	0.54	0.48	81	0.38	0.82	113	0.53	0.53
18	0.50	0.60	50	0.50	0.60	82	0.75	0.11	114	0.49	0.61
19	0.50	0.60	51	0.88	0.01	83	0.57	0.39	115	0.66	0.21
20	0.72	0.13	52	0.77	0.07	84	0.39	0.79	116	0.60	0.33
21	0.79	0.06	53	0.55	0.44	84	0.36	0.85	117	0.57	0.40
22	0.47	0.65	54	0.74	0.12	86	0.31	0.94	118	0.63	0.31
23	0.58	0.36	55	0.76	0.09	87	0.47	0.65	119	0.45	0.72
24	0.67	0.19	56	0.46	0.71	88	0.47	0.67	120	0.68	0.17
25	0.70	0.16	57	0.64	0.25	89	0.61	0.32	121	0.70	0.16
26	0.35	0.89	58	0.85	0.03	90	0.47	0.65	122	0.84	0.05
27	0.27	0.98	59	0.40	0.78	91	0.50	0.60	123	0.49	0.61
28	0.67	0.19	60	0.77	0.07	92	0.48	0.63	124	0.30	0.96
29	0.54	0.49	61	0.53	0.53	93	0.59	0.36	125	0.35	0.89
30	0.63	0.29	62	0.76	0.09	94	0.30	0.96	126	0.64	0.27
31	0.35	0.89	63	0.55	0.42	95	0.48	0.62			
32	0.46	0.70	64	0.55	0.44	96	0.54	0.48			

Table 6.32. Frequency table of EG and PR of Physics-Chemistry – 3rd cycle from 1972.

SN	EG	PR	SN	EC	PR	SN	EC	PR
1	.42	.64	21	.50	.42	41	.58	.28
2	.36	.84	22	.46	.53	42	.39	.75
3	.05	.42	23	.52	.37	43	.49	.46
4	.52	.37	24	.39	.75	44	.72	.02
5	.59	.23	25	.54	.32	45	.65	.09
6	.33	.88	26	.40	.67	46	.40	.67
7	.64	.11	27	.36	.84	47	.65	.09
8	.54	.33	28	.65	.09	48	.60	.16
9	.59	.26	29	.32	.90	49	.60	.19
10	.39	.68	30	.59	.23	50	.68	.04
11	.39	.75	31	.28	.93	51	.26	.97
12	.60	.16	32	.59	.26	52	.60	.16
13	.18	1.0	33	.44	.56	53	.45	.54
14	.43	.60	34	.37	.79	54	.31	.91
15	.39	.75	35	.35	.86	55	.49	.44
16	.27	.95	36	.37	.77	56	.54	.32
17	.51	.37	37	.47	.51			
18	.43	.60	38	.41	.63			
19	.48	.47	39	.60	.19			
20	.25	.98	40	.36	.84			

Physics 12th grade

Table 6.33. Frequency table of EG and PR of Physics 12th grade from 1982.

SN	EG	PR	SN	EC	PR	SN	EC	PR	SN	EC	PR
1	0.06	1.00	45	0.31	0.88	89	0.41	0.74	133	0.48	0.62
2	0.10	1.00	46	0.32	0.87	90	0.41	0.74	134	0.48	0.62
3	0.11	0.99	47	0.32	0.87	91	0.41	0.74	135	0.48	0.62
4	0.11	0.99	48	0.32	0.87	92	0.41	0.74	136	0.48	0.62
5	0.14	0.99	49	0.32	0.87	93	0.42	0.73	137	0.48	0.62
6	0.16	0.99	50	0.33	0.86	94	0.42	0.73	138	0.48	0.62
7	0.19	0.98	51	0.33	0.85	95	0.42	0.73	139	0.48	0.62
8	0.20	0.98	52	0.33	0.85	96	0.42	0.73	140	0.49	0.60
9	0.20	0.98	53	0.34	0.85	97	0.42	0.73	141	0.49	0.60
10	0.20	0.98	54	0.34	0.85	98	0.43	0.72	142	0.49	0.60
11	0.21	0.97	55	0.34	0.85	99	0.43	0.72	143	0.50	0.59
12	0.23	0.97	56	0.34	0.85	100	0.43	0.72	144	0.50	0.59
13	0.23	0.97	57	0.34	0.85	101	0.43	0.72	145	0.50	0.59
14	0.23	0.96	58	0.34	0.85	102	0.43	0.72	146	0.50	0.59
15	0.23	0.96	59	0.34	0.85	103	0.43	0.70	147	0.50	0.59
16	0.24	0.95	60	0.35	0.83	104	0.44	0.70	148	0.50	0.59
17	0.24	0.95	61	0.35	0.83	105	0.44	0.70	149	0.50	0.59
18	0.24	0.95	62	0.35	0.83	106	0.44	0.70	150	0.51	0.57
19	0.24	0.95	63	0.35	0.82	107	0.44	0.70	151	0.52	0.57
20	0.24	0.95	64	0.35	0.82	108	0.44	0.70	152	0.52	0.57
21	0.24	0.94	65	0.35	0.82	109	0.44	0.69	153	0.52	0.57
22	0.25	0.94	66	0.36	0.81	110	0.44	0.69	154	0.52	0.56
23	0.25	0.94	67	0.36	0.81	111	0.45	0.68	155	0.52	0.56
24	0.25	0.93	68	0.36	0.81	112	0.45	0.68	156	0.52	0.56
25	0.25	0.93	69	0.37	0.80	113	0.45	0.68	157	0.52	0.56
26	0.25	0.93	70	0.37	0.80	114	0.45	0.68	158	0.52	0.56
27	0.25	0.93	71	0.37	0.80	115	0.45	0.68	159	0.52	0.56
28	0.26	0.92	72	0.38	0.79	116	0.46	0.67	160	0.52	0.56
29	0.26	0.92	73	0.38	0.79	117	0.46	0.67	161	0.53	0.54
30	0.26	0.91	74	0.38	0.79	118	0.46	0.67	162	0.53	0.54
31	0.27	0.91	75	0.39	0.79	119	0.46	0.66	163	0.53	0.54
32	0.27	0.91	76	0.39	0.79	120	0.46	0.66	164	0.53	0.54
33	0.28	0.91	77	0.39	0.78	121	0.47	0.65	165	0.53	0.54
34	0.28	0.91	78	0.39	0.78	122	0.47	0.65	166	0.53	0.54
35	0.29	0.90	79	0.39	0.78	123	0.47	0.65	167	0.53	0.54
36	0.29	0.90	80	0.39	0.78	124	0.47	0.64	168	0.53	0.54
37	0.30	0.89	81	0.40	0.77	125	0.47	0.64	169	0.54	0.52
38	0.30	0.89	82	0.40	0.77	126	0.47	0.64	170	0.54	0.52
39	0.31	0.89	83	0.40	0.77	127	0.47	0.64	171	0.54	0.51
40	0.31	0.89	84	0.40	0.77	128	0.47	0.64	172	0.54	0.51
41	0.31	0.89	84	0.40	0.77	129	0.47	0.64	173	0.54	0.51
42	0.31	0.89	86	0.40	0.77	130	0.47	0.64	174	0.54	0.51
43	0.31	0.88	87	0.40	0.77	131	0.48	0.62	175	0.54	0.51
44	0.31	0.88	88	0.40	0.77	132	0.48	0.62	176	0.54	0.51

SN	EG	PR	SN	EC	PR	SN	EC	PR	SN	EC	PR
177	0.54	0.51	221	0.61	0.37	265	0.68	0.24	309	0.75	0.12
178	0.54	0.51	222	0.61	0.37	266	0.68	0.24	310	0.76	0.11
179	0.55	0.49	223	0.61	0.37	267	0.68	0.24	311	0.76	0.11
180	0.55	0.49	224	0.61	0.37	268	0.68	0.24	312	0.76	0.11
181	0.55	0.49	225	0.62	0.36	269	0.69	0.23	313	0.77	0.10
182	0.55	0.48	226	0.62	0.36	270	0.70	0.23	314	0.77	0.10
183	0.55	0.48	227	0.62	0.36	271	0.70	0.23	315	0.77	0.10
184	0.55	0.48	228	0.62	0.36	272	0.70	0.23	316	0.78	0.09
185	0.55	0.48	229	0.62	0.34	273	0.70	0.23	317	0.78	0.09
186	0.55	0.48	230	0.63	0.34	274	0.70	0.23	318	0.79	0.09
187	0.55	0.48	231	0.63	0.34	275	0.70	0.23	319	0.80	0.09
188	0.56	0.46	232	0.63	0.34	276	0.70	0.21	320	0.80	0.09
189	0.56	0.46	233	0.63	0.33	277	0.70	0.21	321	0.80	0.09
190	0.56	0.46	234	0.63	0.33	278	0.70	0.21	322	0.80	0.09
191	0.56	0.46	235	0.63	0.33	279	0.70	0.21	323	0.80	0.09
192	0.57	0.45	236	0.64	0.32	280	0.70	0.21	324	0.80	0.09
193	0.57	0.45	237	0.64	0.32	281	0.71	0.19	325	0.81	0.07
194	0.57	0.44	238	0.64	0.32	282	0.71	0.19	326	0.83	0.07
195	0.57	0.44	239	0.64	0.32	283	0.71	0.19	327	0.83	0.07
196	0.57	0.44	240	0.64	0.32	284	0.71	0.19	328	0.83	0.07
197	0.58	0.44	241	0.64	0.32	285	0.71	0.19	329	0.83	0.06
198	0.58	0.44	242	0.64	0.32	286	0.72	0.18	330	0.84	0.05
199	0.59	0.43	243	0.64	0.32	287	0.72	0.18	331	0.84	0.05
200	0.59	0.43	244	0.64	0.30	288	0.72	0.18	332	0.84	0.05
201	0.59	0.42	245	0.64	0.30	289	0.72	0.18	333	0.84	0.05
202	0.59	0.42	246	0.64	0.30	290	0.72	0.18	334	0.85	0.04
203	0.59	0.42	247	0.65	0.29	291	0.72	0.17	335	0.85	0.04
204	0.59	0.42	248	0.65	0.29	292	0.73	0.16	336	0.86	0.04
205	0.59	0.42	249	0.65	0.29	293	0.74	0.16	337	0.86	0.03
206	0.59	0.42	250	0.65	0.29	294	0.74	0.16	338	0.89	0.03
207	0.60	0.41	251	0.65	0.29	295	0.74	0.16	339	0.90	0.03
208	0.60	0.41	252	0.65	0.29	296	0.74	0.16	340	0.90	0.03
209	0.60	0.41	253	0.66	0.28	297	0.74	0.16	341	0.90	0.03
210	0.60	0.41	254	0.66	0.28	298	0.74	0.16	342	0.90	0.03
211	0.60	0.41	255	0.66	0.28	299	0.74	0.16	343	0.90	0.03
212	0.60	0.41	256	0.66	0.28	300	0.74	0.16	344	0.94	0.01
213	0.60	0.41	257	0.66	0.26	301	0.74	0.16	345	0.94	0.01
214	0.60	0.41	258	0.66	0.26	302	0.74	0.16	346	0.95	0.01
215	0.60	0.41	259	0.66	0.26	303	0.74	0.13	347	0.96	0.01
216	0.60	0.41	260	0.67	0.26	304	0.74	0.13	348	1.00	0.00
217	0.60	0.41	261	0.67	0.26	305	0.75	0.13			
218	0.61	0.38	262	0.67	0.26	306	0.75	0.13			
219	0.61	0.37	263	0.67	0.26	307	0.75	0.12			
220	0.61	0.37	264	0.67	0.24	308	0.75	0.12			

Table 6.34. Frequency table of EG and PR of Physics 12th grade from 1983.

SN	EG	PR	SN	EG	PR	SN	EG	PR	SN	EG	PR
1	0.05	1.00	38	0.40	0.76	75	0.50	0.61	112	0.75	0.25
2	0.05	1.00	39	0.40	0.76	76	0.50	0.61	113	0.75	0.25
3	0.06	0.99	40	0.40	0.76	77	0.50	0.61	114	0.75	0.25
4	0.07	0.98	41	0.40	0.76	78	0.55	0.48	115	0.75	0.25
5	0.08	0.97	42	0.40	0.76	79	0.55	0.48	116	0.75	0.25
6	0.10	0.97	43	0.40	0.76	80	0.55	0.48	117	0.75	0.25
7	0.15	0.96	44	0.40	0.76	81	0.55	0.48	118	0.75	0.25
8	0.15	0.96	45	0.40	0.76	82	0.55	0.48	119	0.75	0.25
9	0.15	0.96	46	0.40	0.76	83	0.55	0.48	120	0.75	0.25
10	0.20	0.94	47	0.40	0.76	84	0.55	0.48	121	0.75	0.25
11	0.20	0.94	48	0.45	0.68	84	0.55	0.48	122	0.75	0.25
12	0.20	0.94	49	0.45	0.68	86	0.55	0.48	123	0.75	0.25
13	0.20	0.94	50	0.45	0.68	87	0.60	0.41	124	0.75	0.25
14	0.20	0.94	51	0.45	0.68	88	0.60	0.41	125	0.80	0.16
15	0.20	0.94	52	0.45	0.68	89	0.60	0.41	126	0.80	0.16
16	0.20	0.94	53	0.45	0.68	90	0.60	0.41	127	0.80	0.16
17	0.25	0.89	54	0.45	0.68	91	0.60	0.41	128	0.80	0.16
18	0.25	0.89	55	0.45	0.68	92	0.60	0.41	129	0.80	0.16
19	0.25	0.89	56	0.45	0.68	93	0.60	0.41	130	0.80	0.16
20	0.25	0.89	57	0.45	0.68	94	0.60	0.41	131	0.80	0.16
21	0.25	0.89	58	0.45	0.68	95	0.60	0.41	132	0.80	0.16
22	0.30	0.86	59	0.50	0.61	96	0.60	0.41	133	0.80	0.16
23	0.30	0.86	60	0.50	0.61	97	0.65	0.35	134	0.80	0.16
24	0.30	0.86	61	0.50	0.61	98	0.65	0.35	135	0.80	0.16
25	0.30	0.86	62	0.50	0.61	99	0.65	0.35	136	0.80	0.16
26	0.30	0.86	63	0.50	0.61	100	0.65	0.35	137	0.85	0.07
27	0.30	0.86	64	0.50	0.61	101	0.65	0.35	138	0.85	0.07
28	0.30	0.86	65	0.50	0.61	102	0.65	0.35	139	0.85	0.07
29	0.30	0.86	66	0.50	0.61	103	0.70	0.31	140	0.85	0.07
30	0.30	0.86	67	0.50	0.61	104	0.70	0.31	141	0.85	0.07
31	0.35	0.80	68	0.50	0.61	105	0.70	0.31	142	0.90	0.04
32	0.35	0.80	69	0.50	0.61	106	0.70	0.31	143	0.90	0.04
33	0.35	0.80	70	0.50	0.61	107	0.70	0.31	144	0.90	0.04
34	0.35	0.80	71	0.50	0.61	108	0.70	0.31	145	0.90	0.04
35	0.35	0.80	72	0.50	0.61	109	0.70	0.31	146	0.95	0.01
36	0.35	0.80	73	0.50	0.61	110	0.70	0.31	147	1.00	0.01
37	0.40	0.76	74	0.50	0.61	111	0.75	0.25			

Table 6.35. Frequency table of EG and PR of Physics 12th grade from 1984.

SN	EG	PR	SN	EG	PR	SN	EG	PR	SN	EG	PR
1	0.15	1.00	34	0.40	0.78	67	0.50	0.55	100	0.65	0.29
2	0.15	1.00	35	0.40	0.78	68	0.50	0.55	101	0.65	0.29
3	0.15	1.00	36	0.40	0.78	69	0.50	0.55	102	0.65	0.29
4	0.15	1.00	37	0.40	0.78	70	0.50	0.55	103	0.70	0.21
5	0.20	0.97	38	0.40	0.78	71	0.50	0.55	104	0.70	0.21
6	0.20	0.97	39	0.40	0.78	72	0.50	0.55	105	0.70	0.21
7	0.20	0.97	40	0.40	0.78	73	0.55	0.44	106	0.70	0.21
8	0.20	0.97	41	0.40	0.78	74	0.55	0.44	107	0.70	0.21
9	0.25	0.94	42	0.40	0.78	75	0.55	0.44	108	0.70	0.21
10	0.25	0.94	43	0.40	0.78	76	0.55	0.44	109	0.70	0.21
11	0.25	0.94	44	0.40	0.78	77	0.55	0.44	110	0.70	0.21
12	0.25	0.94	45	0.40	0.78	78	0.55	0.44	111	0.70	0.21
13	0.25	0.94	46	0.40	0.78	79	0.55	0.44	112	0.75	0.14
14	0.25	0.94	47	0.40	0.78	80	0.55	0.44	113	0.75	0.14
15	0.25	0.94	48	0.40	0.78	81	0.55	0.44	114	0.75	0.14
16	0.25	0.94	49	0.45	0.63	82	0.55	0.44	115	0.75	0.14
17	0.30	0.88	50	0.45	0.63	83	0.55	0.44	116	0.75	0.14
18	0.30	0.88	51	0.45	0.63	84	0.60	0.36	117	0.75	0.14
19	0.35	0.86	52	0.45	0.63	84	0.60	0.36	118	0.75	0.14
20	0.35	0.86	53	0.45	0.63	86	0.60	0.36	119	0.75	0.14
21	0.35	0.86	54	0.45	0.63	87	0.60	0.36	120	0.80	0.08
22	0.35	0.86	55	0.45	0.63	88	0.60	0.36	121	0.80	0.08
23	0.35	0.86	56	0.45	0.63	89	0.60	0.36	122	0.85	0.06
24	0.35	0.86	57	0.45	0.63	90	0.60	0.36	123	0.85	0.06
25	0.35	0.86	58	0.45	0.63	91	0.60	0.36	124	0.90	0.05
26	0.35	0.86	59	0.50	0.55	92	0.65	0.29	125	0.90	0.05
27	0.35	0.86	60	0.50	0.55	93	0.65	0.29	126	0.90	0.05
28	0.35	0.86	61	0.50	0.55	94	0.65	0.29	127	0.90	0.05
29	0.35	0.86	62	0.50	0.55	95	0.65	0.29	128	0.95	0.02
30	0.40	0.78	63	0.50	0.55	96	0.65	0.29	129	1.00	0.01
31	0.40	0.78	64	0.50	0.55	97	0.65	0.29			
32	0.40	0.78	65	0.50	0.55	98	0.65	0.29			
33	0.40	0.78	66	0.50	0.55	99	0.65	0.29			

Table 6.36. Frequency table of EG and PR of Physics 12th grade from 2004

NS	EG	PR	NS	EG	PR	NS	EG	PR	NS	EG	PR
10	0.00	1.000	27	0.16	0.955	47	0.31	0.797	28	0.46	0.580
1	0.01	0.999	27	0.17	0.952	27	0.32	0.792	9	0.47	0.576
3	0.01	0.999	9	0.17	0.949	12	0.32	0.789	3	0.47	0.575
1	0.02	0.998	74	0.18	0.948	118	0.33	0.788	263	0.48	0.575
2	0.03	0.998	36	0.18	0.939	73	0.33	0.774	104	0.48	0.545
6	0.04	0.998	35	0.19	0.935	70	0.34	0.766	75	0.49	0.533
7	0.04	0.997	31	0.19	0.931	65	0.34	0.757	69	0.49	0.524
6	0.05	0.997	45	0.20	0.928	57	0.35	0.750	64	0.50	0.516
6	0.05	0.996	51	0.20	0.922	56	0.35	0.743	110	0.50	0.509
10	0.06	0.995	33	0.21	0.917	56	0.36	0.737	67	0.51	0.496
6	0.06	0.994	38	0.21	0.913	45	0.36	0.731	63	0.51	0.488
6	0.07	0.993	27	0.22	0.908	22	0.37	0.725	25	0.52	0.481
2	0.07	0.993	10	0.22	0.905	10	0.37	0.723	2	0.52	0.478
6	0.08	0.992	94	0.23	0.904	167	0.38	0.722	156	0.53	0.478
18	0.08	0.992	55	0.23	0.893	70	0.38	0.702	84	0.53	0.460
11	0.09	0.990	40	0.24	0.887	74	0.39	0.694	63	0.54	0.450
20	0.09	0.988	32	0.24	0.882	82	0.39	0.686	70	0.54	0.443
14	0.10	0.986	50	0.25	0.879	66	0.40	0.676	75	0.55	0.435
12	0.10	0.984	58	0.25	0.873	81	0.40	0.669	92	0.55	0.426
21	0.11	0.983	54	0.26	0.866	50	0.41	0.659	86	0.56	0.416
19	0.11	0.981	50	0.26	0.860	46	0.41	0.654	41	0.56	0.406
11	0.12	0.978	27	0.27	0.854	22	0.42	0.648	13	0.57	0.401
8	0.12	0.977	15	0.27	0.851	4	0.42	0.646	7	0.57	0.400
25	0.13	0.976	113	0.28	0.849	198	0.43	0.645	174	0.58	0.399
26	0.13	0.973	68	0.28	0.836	75	0.43	0.623	58	0.58	0.379
22	0.14	0.970	46	0.29	0.829	58	0.44	0.614	79	0.59	0.372
27	0.14	0.968	48	0.29	0.823	69	0.44	0.607	67	0.59	0.363
22	0.15	0.965	54	0.30	0.818	65	0.45	0.599	60	0.60	0.355
33	0.15	0.962	67	0.30	0.811	66	0.45	0.592	67	0.60	0.348
31	0.16	0.959	55	0.31	0.804	41	0.46	0.584	59	0.61	0.341

Note: NS – number of students. (due to the great number of students)

NS	EG	PR	NS	EG	PR	NS	EG	PR
43	0.61	0.334	37	0.76	0.148	19	0.91	0.031
15	0.62	0.329	11	0.77	0.144	13	0.92	0.029
4	0.62	0.327	3	0.77	0.143	1	0.92	0.027
177	0.63	0.327	118	0.78	0.142	56	0.93	0.027
60	0.63	0.306	46	0.78	0.129	17	0.93	0.020
52	0.64	0.299	54	0.79	0.124	24	0.94	0.019
34	0.64	0.293	35	0.79	0.117	22	0.94	0.016
75	0.65	0.290	28	0.80	0.113	11	0.95	0.013
72	0.65	0.281	46	0.80	0.110	15	0.95	0.012
52	0.66	0.273	37	0.81	0.105	15	0.96	0.010
37	0.66	0.267	34	0.81	0.101	9	0.96	0.009
16	0.67	0.262	14	0.82	0.097	3	0.97	0.007
3	0.67	0.261	4	0.82	0.095	4	0.97	0.007
143	0.68	0.261	94	0.83	0.095	20	0.98	0.007
56	0.68	0.244	38	0.83	0.084	11	0.98	0.004
41	0.69	0.237	35	0.84	0.079	14	0.99	0.003
41	0.69	0.233	35	0.84	0.075	7	0.99	0.001
46	0.70	0.225	29	0.85	0.071	1	1.00	0.001
67	0.70	0.220	34	0.85	0.068	5	1.00	0.001
37	0.71	0.212	23	0.86	0.064			
34	0.71	0.208	22	0.86	0.061			
19	0.72	0.204	6	0.87	0.059			
5	0.72	0.202	4	0.87	0.058			
129	0.73	0.201	68	0.88	0.058			
71	0.73	0.186	31	0.88	0.050			
40	0.74	0.178	26	0.89	0.046			
45	0.74	0.174	26	0.89	0.043			
60	0.75	0.168	29	0.90	0.040			
59	0.75	0.162	27	0.90	0.037			
56	0.76	0.155	27	0.91	0.034			

Table 6.37. Frequency table of EG and PR of Physics 12th grade from 2005.

NS	EG	PR	NS	EG	PR	NS	EG	PR	NS	EG	PR
1	0.00	1.000	15	0.18	0.979	92	0.33	0.890	236	0.48	0.716
1	0.02	1.000	9	0.18	0.977	51	0.33	0.877	82	0.48	0.685
1	0.03	1.000	14	0.19	0.976	26	0.34	0.870	64	0.49	0.673
1	0.04	1.000	17	0.19	0.974	39	0.34	0.867	56	0.49	0.665
1	0.04	0.999	13	0.20	0.972	41	0.35	0.862	53	0.50	0.657
2	0.05	0.999	19	0.20	0.970	56	0.35	0.856	65	0.50	0.650
2	0.06	0.999	23	0.21	0.968	46	0.36	0.849	69	0.51	0.641
1	0.06	0.999	15	0.21	0.965	36	0.36	0.843	48	0.51	0.632
3	0.07	0.999	7	0.22	0.963	19	0.37	0.838	24	0.52	0.626
4	0.07	0.998	7	0.22	0.962	9	0.37	0.835	10	0.52	0.623
4	0.08	0.998	41	0.23	0.961	82	0.38	0.834	155	0.53	0.621
2	0.08	0.997	13	0.23	0.955	62	0.38	0.823	75	0.53	0.600
4	0.09	0.997	20	0.24	0.953	47	0.39	0.815	65	0.54	0.590
6	0.09	0.996	27	0.24	0.951	47	0.39	0.808	69	0.54	0.581
1	0.10	0.996	26	0.25	0.947	48	0.40	0.802	70	0.55	0.572
6	0.10	0.995	34	0.25	0.944	44	0.40	0.795	72	0.55	0.563
2	0.11	0.995	17	0.26	0.939	44	0.41	0.790	49	0.56	0.553
7	0.11	0.994	22	0.26	0.937	32	0.41	0.784	49	0.56	0.547
4	0.12	0.993	12	0.27	0.934	16	0.42	0.779	24	0.57	0.540
2	0.12	0.993	9	0.27	0.932	5	0.42	0.777	10	0.57	0.537
9	0.13	0.993	51	0.28	0.931	119	0.43	0.776	152	0.58	0.535
12	0.13	0.991	36	0.28	0.924	59	0.43	0.760	78	0.58	0.515
11	0.14	0.990	35	0.29	0.919	65	0.44	0.753	73	0.59	0.504
11	0.14	0.988	35	0.29	0.915	45	0.44	0.744	63	0.59	0.495
9	0.15	0.987	34	0.30	0.910	53	0.45	0.738	72	0.60	0.486
10	0.15	0.986	30	0.30	0.905	45	0.45	0.731	78	0.60	0.476
8	0.16	0.984	29	0.31	0.901	41	0.46	0.725	69	0.61	0.466
15	0.16	0.983	26	0.31	0.897	13	0.46	0.719	50	0.61	0.457
5	0.17	0.981	20	0.32	0.894	4	0.47	0.717	25	0.62	0.450
8	0.17	0.981	11	0.32	0.891	4	0.47	0.717	9	0.62	0.447

NS	EG	PR	NS	EG	PR	NS	EG	PR
141	0.63	0.445	118	0.78	0.212	57	0.93	0.039
77	0.63	0.426	59	0.78	0.196	27	0.93	0.031
64	0.64	0.416	51	0.79	0.188	21	0.94	0.028
50	0.64	0.407	43	0.79	0.181	13	0.94	0.025
63	0.65	0.401	45	0.80	0.175	22	0.95	0.023
68	0.65	0.392	52	0.80	0.169	20	0.95	0.020
71	0.66	0.383	52	0.81	0.162	24	0.96	0.017
43	0.66	0.374	43	0.81	0.155	8	0.96	0.014
23	0.67	0.368	14	0.82	0.150	12	0.97	0.013
3	0.67	0.365	7	0.82	0.148	3	0.97	0.011
112	0.68	0.364	112	0.83	0.147	29	0.98	0.011
70	0.68	0.349	55	0.83	0.132	12	0.98	0.007
61	0.69	0.340	43	0.84	0.124	11	0.99	0.006
65	0.69	0.332	30	0.84	0.118	13	0.99	0.004
64	0.70	0.323	51	0.85	0.114	2	1.00	0.002
77	0.70	0.314	49	0.85	0.108	15	1.00	0.002
62	0.71	0.304	36	0.86	0.101			
34	0.71	0.296	31	0.86	0.096			
19	0.72	0.291	21	0.87	0.092			
3	0.72	0.288	5	0.87	0.089			
109	0.73	0.288	85	0.88	0.088			
56	0.73	0.273	48	0.88	0.077			
68	0.74	0.266	47	0.89	0.071			
56	0.74	0.257	47	0.89	0.064			
66	0.75	0.249	28	0.90	0.058			
67	0.75	0.240	31	0.90	0.054			
61	0.76	0.231	36	0.91	0.050			
45	0.76	0.223	29	0.91	0.045			
29	0.77	0.217	11	0.92	0.041			
10	0.77	0.213	7	0.92	0.040			

Chemistry 12th grade

Table 6.38. Frequency table of EG and PR of Chemistry 12th grade from 1982.

SN	EG	PR	SN	EC	PR	SN	EC	PR	SN	EC	PR
1	0.02	1.00	45	0.31	0.86	89	0.39	0.74	133	0.50	0.60
2	0.10	1.00	46	0.31	0.86	90	0.40	0.73	134	0.51	0.59
3	0.11	0.99	47	0.32	0.86	91	0.41	0.72	135	0.51	0.59
4	0.13	0.99	48	0.32	0.85	92	0.41	0.72	136	0.51	0.59
5	0.13	0.99	49	0.32	0.85	93	0.41	0.72	137	0.51	0.58
6	0.15	0.98	50	0.33	0.85	94	0.41	0.72	138	0.51	0.58
7	0.15	0.98	51	0.33	0.85	95	0.41	0.71	139	0.51	0.58
8	0.16	0.98	52	0.33	0.84	96	0.42	0.71	140	0.51	0.58
9	0.16	0.97	53	0.34	0.84	97	0.42	0.71	141	0.52	0.57
10	0.17	0.97	54	0.34	0.84	98	0.42	0.71	142	0.52	0.57
11	0.18	0.97	55	0.34	0.84	99	0.42	0.70	143	0.52	0.56
12	0.18	0.96	56	0.34	0.84	100	0.43	0.70	144	0.52	0.56
13	0.19	0.96	57	0.35	0.82	101	0.43	0.70	145	0.52	0.56
14	0.19	0.96	58	0.35	0.82	102	0.43	0.69	146	0.52	0.56
15	0.19	0.96	59	0.35	0.82	103	0.43	0.69	147	0.52	0.56
16	0.20	0.95	60	0.35	0.82	104	0.43	0.69	148	0.52	0.56
17	0.21	0.95	61	0.36	0.81	105	0.43	0.69	149	0.53	0.54
18	0.22	0.94	62	0.36	0.81	106	0.44	0.68	150	0.53	0.54
19	0.22	0.94	63	0.36	0.81	107	0.44	0.67	151	0.53	0.54
20	0.22	0.94	64	0.36	0.81	108	0.44	0.67	152	0.53	0.54
21	0.23	0.94	65	0.36	0.81	109	0.44	0.67	153	0.53	0.54
22	0.23	0.94	66	0.36	0.80	110	0.45	0.66	154	0.54	0.53
23	0.23	0.94	67	0.36	0.80	111	0.45	0.66	155	0.54	0.53
24	0.23	0.93	68	0.37	0.79	112	0.46	0.66	156	0.54	0.53
25	0.24	0.92	69	0.37	0.79	113	0.46	0.66	157	0.54	0.52
26	0.24	0.92	70	0.37	0.79	114	0.46	0.65	158	0.54	0.52
27	0.26	0.92	71	0.37	0.79	115	0.46	0.65	159	0.54	0.52
28	0.26	0.91	72	0.37	0.79	116	0.47	0.65	160	0.54	0.52
29	0.26	0.91	73	0.37	0.78	117	0.47	0.64	161	0.55	0.51
30	0.27	0.91	74	0.37	0.78	118	0.48	0.64	162	0.55	0.51
31	0.27	0.91	75	0.37	0.78	119	0.48	0.64	163	0.55	0.51
32	0.27	0.90	76	0.37	0.78	120	0.49	0.63	164	0.55	0.50
33	0.27	0.90	77	0.38	0.77	121	0.49	0.63	165	0.55	0.50
34	0.28	0.90	78	0.38	0.77	122	0.49	0.63	166	0.55	0.50
35	0.28	0.90	79	0.38	0.77	123	0.49	0.63	167	0.55	0.50
36	0.29	0.89	80	0.38	0.76	124	0.49	0.63	168	0.55	0.50
37	0.29	0.89	81	0.38	0.76	125	0.49	0.63	169	0.56	0.48
38	0.29	0.89	82	0.38	0.76	126	0.49	0.63	170	0.56	0.48
39	0.29	0.88	83	0.38	0.76	127	0.50	0.61	171	0.56	0.48
40	0.30	0.88	84	0.39	0.74	128	0.50	0.61	172	0.56	0.48
41	0.30	0.87	84	0.39	0.74	129	0.50	0.61	173	0.57	0.47
42	0.30	0.87	86	0.39	0.74	130	0.50	0.61	174	0.57	0.47
43	0.30	0.87	87	0.39	0.74	131	0.50	0.61	175	0.57	0.47
44	0.31	0.86	88	0.39	0.74	132	0.50	0.60	176	0.57	0.47

SN	EG	PR	SN	EC	PR	SN	EC	PR	SN	EC	PR
177	0.58	0.46	216	0.68	0.33	255	0.78	0.19	294	0.92	0.05
178	0.58	0.46	217	0.68	0.32	256	0.79	0.18	295	0.92	0.05
179	0.58	0.46	218	0.68	0.32	257	0.79	0.18	296	0.92	0.05
180	0.58	0.46	219	0.68	0.32	258	0.79	0.18	297	0.92	0.04
181	0.58	0.45	220	0.68	0.32	259	0.79	0.18	298	0.92	0.04
182	0.58	0.45	221	0.69	0.31	260	0.79	0.18	299	0.93	0.04
183	0.59	0.44	222	0.69	0.31	261	0.80	0.17	300	0.94	0.03
184	0.59	0.44	223	0.69	0.30	262	0.80	0.17	301	0.94	0.03
185	0.59	0.44	224	0.69	0.30	263	0.80	0.17	302	0.94	0.03
186	0.59	0.44	225	0.70	0.30	264	0.81	0.16	303	0.94	0.02
187	0.59	0.44	226	0.70	0.30	265	0.81	0.16	304	0.95	0.02
188	0.59	0.44	227	0.70	0.30	266	0.81	0.15	305	0.95	0.02
189	0.60	0.42	228	0.70	0.29	267	0.81	0.15	306	0.95	0.02
190	0.60	0.42	229	0.70	0.29	268	0.81	0.15	307	0.96	0.01
191	0.60	0.42	230	0.70	0.29	269	0.82	0.14	308	0.96	0.01
192	0.60	0.41	231	0.70	0.29	270	0.82	0.14	309	0.97	0.01
193	0.61	0.41	232	0.70	0.29	271	0.82	0.14	310	0.99	0.00
194	0.61	0.41	233	0.71	0.27	272	0.82	0.14	311	0.92	0.05
195	0.61	0.41	234	0.71	0.27	273	0.83	0.13	309	0.92	0.05
196	0.62	0.40	235	0.72	0.26	274	0.84	0.13	310	0.92	0.05
197	0.62	0.40	236	0.72	0.26	275	0.84	0.13	309	0.92	0.04
198	0.62	0.40	237	0.73	0.26	276	0.84	0.13	310	0.92	0.04
199	0.62	0.40	238	0.73	0.26	277	0.84	0.13	311	0.93	0.04
200	0.63	0.39	239	0.73	0.26	278	0.85	0.12	312	0.94	0.03
201	0.63	0.39	240	0.74	0.25	279	0.85	0.11	313	0.94	0.03
202	0.63	0.38	241	0.74	0.25	280	0.85	0.11	314	0.94	0.03
203	0.64	0.38	242	0.74	0.24	281	0.85	0.11	315	0.94	0.02
204	0.64	0.38	243	0.74	0.24	282	0.86	0.10	316	0.95	0.02
205	0.65	0.37	244	0.74	0.24	283	0.86	0.10	317	0.95	0.02
206	0.65	0.37	245	0.74	0.24	284	0.87	0.10	318	0.95	0.02
207	0.65	0.37	246	0.74	0.24	285	0.87	0.10	319	0.96	0.01
208	0.65	0.37	247	0.75	0.23	286	0.87	0.10	320	0.96	0.01
209	0.65	0.37	248	0.75	0.23	287	0.87	0.10	321	0.97	0.01
210	0.65	0.36	249	0.75	0.23	288	0.87	0.09	322	0.99	0.00
211	0.66	0.35	250	0.75	0.22	289	0.88	0.08	323	0.92	0.05
212	0.66	0.35	251	0.75	0.22	290	0.88	0.08	324	0.92	0.05
213	0.66	0.35	252	0.75	0.22	291	0.88	0.08	325	0.92	0.05
214	0.66	0.35	253	0.76	0.21	292	0.88	0.07			
215	0.67	0.34	254	0.76	0.21	293	0.90	0.07			

Table 6.39. Frequency table of EG and PR of Chemistry 12th grade from 1983

SN	EG	PR	SN	EG	PR	SN	EG	PR	SN	EG	PR
1	0.03	1.00	31	0.30	0.88	61	0.35	0.79	91	0.40	0.69
2	0.06	1.00	32	0.30	0.88	62	0.35	0.79	92	0.40	0.69
3	0.15	0.99	33	0.30	0.88	63	0.35	0.79	93	0.40	0.69
4	0.15	0.99	34	0.30	0.88	64	0.35	0.79	94	0.45	0.59
5	0.20	0.98	35	0.30	0.88	65	0.35	0.79	95	0.45	0.59
6	0.20	0.98	36	0.30	0.88	66	0.35	0.79	96	0.45	0.59
7	0.20	0.98	37	0.30	0.88	67	0.35	0.79	97	0.45	0.59
8	0.20	0.98	38	0.30	0.88	68	0.35	0.79	98	0.45	0.59
9	0.20	0.98	39	0.30	0.88	69	0.35	0.79	99	0.45	0.59
10	0.20	0.98	40	0.30	0.88	70	0.35	0.79	100	0.45	0.59
11	0.20	0.98	41	0.30	0.88	71	0.35	0.79	101	0.45	0.59
12	0.20	0.98	42	0.30	0.88	72	0.40	0.69	102	0.45	0.59
13	0.20	0.98	43	0.30	0.88	73	0.40	0.69	103	0.45	0.59
14	0.20	0.98	44	0.30	0.88	74	0.40	0.69	104	0.45	0.59
15	0.20	0.98	45	0.30	0.88	75	0.40	0.69	105	0.45	0.59
16	0.20	0.98	46	0.30	0.88	76	0.40	0.69	106	0.45	0.59
17	0.20	0.98	47	0.30	0.88	77	0.40	0.69	107	0.45	0.59
18	0.20	0.98	48	0.35	0.79	78	0.40	0.69	108	0.45	0.59
19	0.20	0.98	49	0.35	0.79	79	0.40	0.69	109	0.45	0.59
20	0.25	0.92	50	0.35	0.79	80	0.40	0.69	110	0.45	0.59
21	0.25	0.92	51	0.35	0.79	81	0.40	0.69	111	0.45	0.59
22	0.25	0.92	52	0.35	0.79	82	0.40	0.69	112	0.45	0.59
23	0.25	0.92	53	0.35	0.79	83	0.40	0.69	113	0.45	0.59
24	0.25	0.92	54	0.35	0.79	84	0.40	0.69	114	0.45	0.59
25	0.25	0.92	55	0.35	0.79	84	0.40	0.69	115	0.45	0.59
26	0.25	0.92	56	0.35	0.79	86	0.40	0.69	116	0.45	0.59
27	0.25	0.92	57	0.35	0.79	87	0.40	0.69	117	0.45	0.59
28	0.30	0.88	58	0.35	0.79	88	0.40	0.69	118	0.50	0.48
29	0.30	0.88	59	0.35	0.79	89	0.40	0.69	119	0.50	0.48
30	0.30	0.88	60	0.35	0.79	90	0.40	0.69	120	0.50	0.48

SN	EG	PR	SN	EG	PR	SN	EG	PR	SN	EG	PR
121	0.50	0.48	151	0.55	0.37	181	0.60	0.26	211	0.70	0.10
122	0.50	0.48	152	0.55	0.37	182	0.60	0.26	212	0.70	0.10
123	0.50	0.48	153	0.55	0.37	183	0.60	0.26	213	0.75	0.07
124	0.50	0.48	154	0.55	0.37	184	0.60	0.26	214	0.75	0.07
125	0.50	0.48	155	0.55	0.37	185	0.60	0.26	215	0.75	0.07
126	0.50	0.48	156	0.55	0.37	186	0.65	0.19	216	0.75	0.07
127	0.50	0.48	157	0.55	0.37	187	0.65	0.19	217	0.75	0.07
128	0.50	0.48	158	0.55	0.37	188	0.65	0.19	218	0.80	0.04
129	0.50	0.48	159	0.55	0.37	189	0.65	0.19	219	0.80	0.04
130	0.50	0.48	160	0.55	0.37	190	0.65	0.19	220	0.80	0.04
131	0.50	0.48	161	0.55	0.37	191	0.65	0.19	221	0.80	0.04
132	0.50	0.48	162	0.55	0.37	192	0.65	0.19	222	0.85	0.03
133	0.50	0.48	163	0.55	0.37	193	0.65	0.19	223	0.85	0.03
134	0.50	0.48	164	0.55	0.37	194	0.65	0.19	224	0.85	0.03
135	0.50	0.48	165	0.55	0.37	195	0.65	0.19	225	0.90	0.01
136	0.50	0.48	166	0.55	0.37	196	0.65	0.19	226	0.90	0.01
137	0.50	0.48	167	0.55	0.37	197	0.65	0.19	227	0.95	0.00
138	0.50	0.48	168	0.55	0.37	198	0.65	0.19			
139	0.50	0.48	169	0.60	0.26	199	0.65	0.19			
140	0.50	0.48	170	0.60	0.26	200	0.65	0.19			
141	0.50	0.48	171	0.60	0.26	201	0.65	0.19			
142	0.50	0.48	172	0.60	0.26	202	0.65	0.19			
143	0.50	0.48	173	0.60	0.26	203	0.65	0.19			
144	0.55	0.37	174	0.60	0.26	204	0.65	0.19			
145	0.55	0.37	175	0.60	0.26	205	0.65	0.19			
146	0.55	0.37	176	0.60	0.26	206	0.70	0.10			
147	0.55	0.37	177	0.60	0.26	207	0.70	0.10			
148	0.55	0.37	178	0.60	0.26	208	0.70	0.10			
149	0.55	0.37	179	0.60	0.26	209	0.70	0.10			
150	0,55	0,37	180	0,60	0,26	210	0,70	0,10			

Table 6.40. Frequency table of EG and PR of Chemistry 12th grade from 1984.

SN	EG	PR	SN	EG	PR	SN	EG	PR	SN	EG	PR
1	0.10	1.00	34	0.40	0.75	67	0.50	0.57	100	0.65	0.25
2	0.20	0.99	35	0.40	0.75	68	0.50	0.57	101	0.65	0.25
3	0.20	0.99	36	0.40	0.75	69	0.50	0.57	102	0.65	0.25
4	0.20	0.99	37	0.40	0.75	70	0.50	0.57	103	0.65	0.25
5	0.25	0.97	38	0.40	0.75	71	0.50	0.57	104	0.65	0.25
6	0.25	0.97	39	0.40	0.75	72	0.55	0.45	105	0.70	0.19
7	0.25	0.97	40	0.40	0.75	73	0.55	0.45	106	0.70	0.19
8	0.25	0.97	41	0.40	0.75	74	0.55	0.45	107	0.70	0.19
9	0.25	0.97	42	0.40	0.75	75	0.55	0.45	108	0.70	0.19
10	0.25	0.97	43	0.40	0.75	76	0.55	0.45	109	0.70	0.19
11	0.25	0.97	44	0.45	0.67	77	0.55	0.45	110	0.75	0.16
12	0.25	0.97	45	0.45	0.67	78	0.55	0.45	111	0.75	0.16
13	0.30	0.91	46	0.45	0.67	79	0.55	0.45	112	0.75	0.16
14	0.30	0.91	47	0.45	0.67	80	0.55	0.45	113	0.75	0.16
15	0.30	0.91	48	0.45	0.67	81	0.55	0.45	114	0.75	0.16
16	0.30	0.91	49	0.45	0.67	82	0.55	0.45	115	0.75	0.16
17	0.30	0.91	50	0.45	0.67	83	0.55	0.45	116	0.75	0.16
18	0.30	0.91	51	0.45	0.67	84	0.55	0.45	117	0.75	0.16
19	0.30	0.91	52	0.45	0.67	84	0.55	0.45	118	0.75	0.16
20	0.30	0.91	53	0.45	0.67	86	0.55	0.45	119	0.80	0.09
21	0.35	0.84	54	0.45	0.67	87	0.55	0.45	120	0.80	0.09
22	0.35	0.84	55	0.45	0.67	88	0.55	0.45	121	0.80	0.09
23	0.35	0.84	56	0.45	0.67	89	0.60	0.32	122	0.80	0.09
24	0.35	0.84	57	0.50	0.57	90	0.60	0.32	123	0.80	0.09
25	0.35	0.84	58	0.50	0.57	91	0.60	0.32	124	0.85	0.05
26	0.35	0.84	59	0.50	0.57	92	0.60	0.32	125	0.85	0.05
27	0.35	0.84	60	0.50	0.57	93	0.60	0.32	126	0.85	0.05
28	0.35	0.84	61	0.50	0.57	94	0.60	0.32	127	0.90	0.02
29	0.35	0.84	62	0.50	0.57	95	0.60	0.32	128	0.95	0.02
30	0.35	0.84	63	0.50	0.57	96	0.60	0.32	129	0.95	0.02
31	0.35	0.84	64	0.50	0.57	97	0.60	0.32			
32	0.35	0.84	65	0.50	0.57	98	0.65	0.25			
33	0.40	0.75	66	0.50	0.57	99	0.65	0.25			

Table 6.41. Frequency table of EG and PR of Chemistry 12th grade from 2004.

NS	EG	PR	NS	EG	PR	NS	EG	PR	NS	EG	PR
26	0.00	1.000	138	0.28	0.866	155	0.53	0.393	76	0.78	0.116
6	0.03	0.998	121	0.29	0.857	121	0.54	0.384	50	0.79	0.112
1	0.03	0.998	116	0.29	0.850	129	0.54	0.377	71	0.79	0.109
2	0.05	0.998	158	0.30	0.843	147	0.55	0.369	52	0.80	0.104
5	0.05	0.998	140	0.30	0.834	126	0.55	0.360	55	0.80	0.101
6	0.06	0.998	129	0.31	0.826	123	0.56	0.353	62	0.81	0.098
4	0.06	0.997	162	0.31	0.818	129	0.56	0.345	53	0.81	0.094
8	0.07	0.997	128	0.32	0.808	77	0.57	0.337	45	0.82	0.091
4	0.07	0.997	67	0.32	0.801	29	0.57	0.333	9	0.82	0.088
7	0.08	0.996	201	0.33	0.796	199	0.58	0.331	111	0.83	0.088
10	0.08	0.996	195	0.33	0.784	148	0.58	0.319	60	0.83	0.081
11	0.09	0.995	153	0.34	0.773	97	0.59	0.310	67	0.84	0.078
4	0.09	0.995	143	0.34	0.764	122	0.59	0.304	50	0.84	0.074
10	0.10	0.994	159	0.35	0.755	107	0.60	0.297	49	0.85	0.071
15	0.10	0.994	170	0.35	0.745	110	0.60	0.291	52	0.85	0.068
15	0.11	0.993	152	0.36	0.735	102	0.61	0.284	56	0.86	0.064
22	0.11	0.992	158	0.36	0.726	88	0.61	0.278	38	0.86	0.061
21	0.12	0.991	126	0.37	0.717	64	0.62	0.273	33	0.87	0.059
17	0.12	0.989	46	0.37	0.709	25	0.62	0.269	14	0.87	0.057
27	0.13	0.988	275	0.38	0.706	168	0.63	0.267	84	0.88	0.056
17	0.13	0.987	190	0.38	0.690	129	0.63	0.257	56	0.88	0.051
26	0.14	0.986	178	0.39	0.678	83	0.64	0.249	60	0.89	0.048
22	0.14	0.984	170	0.39	0.668	87	0.64	0.244	54	0.89	0.044
32	0.15	0.983	180	0.40	0.658	90	0.65	0.239	45	0.90	0.041
36	0.15	0.981	187	0.40	0.647	108	0.65	0.234	54	0.90	0.038
37	0.16	0.979	168	0.41	0.636	89	0.66	0.227	46	0.91	0.035
36	0.16	0.977	152	0.41	0.625	86	0.66	0.222	40	0.91	0.032
37	0.17	0.974	102	0.42	0.616	56	0.67	0.217	31	0.92	0.030
31	0.17	0.972	39	0.42	0.610	15	0.67	0.214	18	0.92	0.028
50	0.18	0.970	321	0.43	0.608	141	0.68	0.213	69	0.93	0.027
50	0.18	0.967	243	0.43	0.589	100	0.68	0.204	45	0.93	0.023
50	0.19	0.964	182	0.44	0.574	82	0.69	0.198	45	0.94	0.020
48	0.19	0.961	188	0.44	0.563	87	0.69	0.193	59	0.94	0.017
63	0.20	0.958	163	0.45	0.552	67	0.70	0.188	42	0.95	0.014
71	0.20	0.955	183	0.45	0.542	83	0.70	0.184	37	0.95	0.011
64	0.21	0.950	166	0.46	0.531	72	0.71	0.179	35	0.96	0.009
80	0.21	0.947	135	0.46	0.521	85	0.71	0.175	44	0.96	0.007
94	0.22	0.942	76	0.47	0.513	50	0.72	0.170	28	0.97	0.004
52	0.22	0.936	11	0.47	0.508	19	0.72	0.167	27	0.97	0.003
104	0.23	0.933	386	0.48	0.508	131	0.73	0.165	61	0.98	0.002
91	0.23	0.927	188	0.48	0.485	88	0.73	0.158	25	0.98	0.001
91	0.24	0.921	156	0.49	0.473	76	0.74	0.152	40	0.99	0.001
90	0.24	0.916	161	0.49	0.464	68	0.74	0.148	39	0.99	0.001
94	0.25	0.910	171	0.50	0.454	71	0.75	0.144	15	1.00	0.001
108	0.25	0.905	168	0.50	0.444	69	0.75	0.139	88	1.00	0.001
112	0.26	0.898	160	0.51	0.434	74	0.76	0.135			
113	0.26	0.891	152	0.51	0.424	54	0.76	0.131			
94	0.27	0.885	102	0.52	0.415	38	0.77	0.128			
48	0.27	0.879	35	0.52	0.409	18	0.77	0.125			
175	0.28	0.876	228	0.53	0.407	134	0.78	0.124			

Table 6.42. Frequency table of EG and PR of Chemistry 12th grade from 2005.

NS	EG	PR	NS	EG	PR	NS	EG	PR	NS	EG	PR
4	0.00	1.000	57	0.27	0.895	68	0.52	0.549	45	0.77	0.226
1	0.02	1.000	174	0.28	0.892	214	0.53	0.546	187	0.78	0.224
2	0.03	1.000	138	0.28	0.884	185	0.53	0.536	149	0.78	0.216
1	0.03	1.000	140	0.29	0.878	169	0.54	0.528	143	0.79	0.209
1	0.04	1.000	125	0.29	0.872	163	0.54	0.520	131	0.79	0.203
2	0.05	1.000	142	0.30	0.866	157	0.55	0.513	112	0.80	0.197
7	0.05	1.000	129	0.30	0.860	163	0.55	0.506	126	0.80	0.192
7	0.06	0.999	129	0.31	0.854	175	0.56	0.498	108	0.81	0.186
3	0.06	0.999	139	0.31	0.848	168	0.56	0.490	124	0.81	0.181
6	0.07	0.999	132	0.32	0.842	116	0.57	0.483	112	0.82	0.176
5	0.07	0.998	78	0.32	0.836	52	0.57	0.478	53	0.82	0.171
5	0.08	0.998	204	0.33	0.832	222	0.58	0.475	159	0.83	0.168
12	0.08	0.998	165	0.33	0.823	183	0.58	0.465	147	0.83	0.161
9	0.09	0.997	146	0.34	0.816	165	0.59	0.457	114	0.84	0.154
15	0.09	0.997	165	0.34	0.809	162	0.59	0.450	114	0.84	0.149
10	0.10	0.996	154	0.35	0.802	147	0.60	0.442	129	0.85	0.144
22	0.10	0.996	148	0.35	0.795	144	0.60	0.436	142	0.85	0.138
29	0.11	0.995	144	0.36	0.788	149	0.61	0.429	100	0.86	0.132
20	0.11	0.994	165	0.36	0.782	137	0.61	0.423	113	0.86	0.127
30	0.12	0.993	122	0.37	0.774	126	0.62	0.416	87	0.87	0.122
15	0.12	0.991	79	0.37	0.769	51	0.62	0.411	57	0.87	0.118
27	0.13	0.991	228	0.38	0.765	239	0.63	0.408	169	0.88	0.116
31	0.13	0.989	192	0.38	0.755	162	0.63	0.398	137	0.88	0.108
31	0.14	0.988	158	0.39	0.746	133	0.64	0.390	101	0.89	0.102
30	0.14	0.987	169	0.39	0.739	149	0.64	0.384	120	0.89	0.098
40	0.15	0.985	151	0.40	0.732	140	0.65	0.378	116	0.90	0.092
43	0.15	0.983	170	0.40	0.725	136	0.65	0.371	104	0.90	0.087
39	0.16	0.982	164	0.41	0.717	148	0.66	0.365	97	0.91	0.082
48	0.16	0.980	151	0.41	0.710	122	0.66	0.359	111	0.91	0.078
47	0.17	0.978	101	0.42	0.703	120	0.67	0.353	94	0.92	0.073
29	0.17	0.976	44	0.42	0.698	48	0.67	0.348	43	0.92	0.069
76	0.18	0.974	271	0.43	0.696	208	0.68	0.346	149	0.93	0.067
73	0.18	0.971	209	0.43	0.684	165	0.68	0.336	123	0.93	0.060
54	0.19	0.968	184	0.44	0.675	155	0.69	0.329	100	0.94	0.055
63	0.19	0.965	175	0.44	0.667	161	0.69	0.322	88	0.94	0.050
61	0.20	0.962	172	0.45	0.659	131	0.70	0.315	105	0.95	0.046
93	0.20	0.960	159	0.45	0.651	139	0.70	0.309	122	0.95	0.041
92	0.21	0.955	146	0.46	0.644	151	0.71	0.303	78	0.96	0.036
86	0.21	0.951	124	0.46	0.637	133	0.71	0.296	73	0.96	0.032
101	0.22	0.947	58	0.47	0.632	90	0.72	0.290	112	0.97	0.029
56	0.22	0.943	33	0.47	0.629	46	0.72	0.286	37	0.97	0.024
114	0.23	0.940	316	0.48	0.627	195	0.73	0.284	76	0.98	0.022
96	0.23	0.935	219	0.48	0.613	160	0.73	0.275	128	0.98	0.019
107	0.24	0.931	196	0.49	0.603	146	0.74	0.268	64	0.99	0.013
97	0.24	0.926	201	0.49	0.595	146	0.74	0.261	33	0.99	0.010
128	0.25	0.922	162	0.50	0.586	137	0.75	0.255	36	1.00	0.009
108	0.25	0.916	193	0.50	0.578	155	0.75	0.248	128	1.00	0.006
121	0.26	0.911	163	0.51	0.570	126	0.76	0.241			
134	0.26	0.906	160	0.51	0.562	117	0.76	0.236			
111	0.27	0.900	143	0.52	0.555	93	0.77	0.230			

C. Extended Angoff Method

The following tables show the values of the items scores, mean and standard deviation per item and per group of items obtained by the examinees in the three groups of items (Group I - multiple choice items, Group II - Group and constructed response items III - lab constructed response items), examinations of Physics and Chemistry in 2003, 2004 and 2005.

Physics Exam 1st Phase, 1st call, 2003

Table 6.43. Data of 275 examinees grades in Group I (MC items), Physics Exam 1st Phase, 1st call, 2003.

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
1	0	0	0	10	0	10	33.3	5.2
2	10	0	0	0	0	0	16.7	4.1
3	10	0	10	0	10	0	50.0	5.5
4	10	10	0	10	0	10	66.7	5.2
5	0	10	10	0	0	0	33.3	5.2
6	0	0	0	10	0	10	33.3	5.2
7	10	10	10	10	10	10	100.0	0.0
8	10	10	10	10	10	10	100.0	0.0
9	0	10	10	10	0	0	50.0	5.5
10	10	10	10	0	0	10	66.7	5.2
11	10	0	10	0	0	0	33.3	5.2
12	10	0	10	10	0	0	50.0	5.5
13	10	10	10	0	0	10	66.7	5.2
14	10	10	10	10	0	0	66.7	5.2
15	10	10	10	10	10	10	100.0	0.0
16	0	0	10	10	10	0	50.0	5.5
17	0	10	10	0	10	0	50.0	5.5
18	10	0	0	0	0	0	16.7	4.1
19	0	0	10	10	10	10	66.7	5.2
20	10	0	0	10	0	10	50.0	5.5
21	10	0	0	10	0	0	33.3	5.2
22	10	10	10	10	10	10	100.0	0.0
23	10	0	10	10	0	10	66.7	5.2
24	10	10	10	10	10	0	83.3	4.1
25	10	10	10	10	10	10	100.0	0.0
26	10	10	10	10	10	0	83.3	4.1
27	10	10	0	10	10	0	66.7	5.2
28	0	0	10	0	0	0	16.7	4.1
29	0	10	10	10	10	10	83.3	4.1
30	0	10	0	10	0	10	50.0	5.5
31	10	10	0	10	0	0	50.0	5.5
32	0	0	10	10	0	0	33.3	5.2
33	10	10	0	10	0	10	66.7	5.2
34	0	0	0	0	0	0	0.0	0.0
35	0	0	0	0	10	0	16.7	4.1

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
36	0	0	10	10	0	0	33.3	5.2
37	0	0	0	0	0	10	16.7	4.1
38	0	0	0	0	0	0	0.0	0.0
39	0	0	0	10	0	0	16.7	4.1
40	10	0	10	0	0	0	33.3	5.2
41	0	10	0	10	0	10	50.0	5.5
42	0	0	0	10	0	0	16.7	4.1
43	10	0	10	10	10	0	66.7	5.2
44	0	0	0	10	0	0	16.7	4.1
45	0	0	10	10	0	0	33.3	5.2
46	0	10	0	10	0	0	33.3	5.2
47	10	0	0	10	0	10	50.0	5.5
48	10	0	0	0	0	0	16.7	4.1
49	10	0	10	10	10	10	83.3	4.1
50	0	10	0	10	10	10	66.7	5.2
51	0	10	10	0	10	10	66.7	5.2
52	0	0	10	10	10	10	66.7	5.2
53	10	0	0	10	0	0	33.3	5.2
54	10	0	10	10	10	10	83.3	4.1
55	0	0	0	0	0	0	0.0	0.0
56	10	0	10	0	0	10	50.0	5.5
57	0	0	0	10	10	0	33.3	5.2
58	10	0	0	10	0	0	33.3	5.2
59	10	0	0	0	0	0	16.7	4.1
60	0	10	10	10	10	10	83.3	4.1
61	0	10	10	10	10	0	66.7	5.2
62	0	10	0	10	10	0	50.0	5.5
63	0	0	0	10	10	10	50.0	5.5
64	10	10	10	0	0	10	66.7	5.2
65	10	0	0	10	0	0	33.3	5.2
66	10	10	0	0	0	0	33.3	5.2
67	10	10	10	10	10	10	100.0	0.0
68	0	10	10	0	0	0	33.3	5.2
69	10	10	10	10	10	10	100.0	0.0
70	10	0	10	10	10	10	83.3	4.1
71	0	0	0	10	10	0	33.3	5.2
72	0	10	0	0	0	10	33.3	5.2
73	0	10	0	10	0	0	33.3	5.2
74	10	0	10	0	0	10	50.0	5.5
75	10	0	0	0	0	0	16.7	4.1
76	0	10	10	10	0	0	50.0	5.5
77	10	10	10	0	0	0	50.0	5.5
78	0	10	10	10	10	0	66.7	5.2
79	0	10	10	0	10	10	66.7	5.2
80	0	10	10	10	10	0	66.7	5.2
81	10	0	0	10	0	0	33.3	5.2
82	10	0	0	0	0	0	16.7	4.1
83	10	10	10	0	10	0	66.7	5.2
84	0	10	10	0	10	10	66.7	5.2
85	0	0	0	10	0	0	16.7	4.1
86	0	0	10	0	0	0	16.7	4.1
87	0	10	10	10	0	0	50.0	5.5
88	0	10	0	0	0	0	16.7	4.1

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
89	0	10	0	0	0	0	16.7	4.1
90	0	0	10	10	0	0	33.3	5.2
91	0	10	10	10	10	10	83.3	4.1
92	0	0	0	10	0	10	33.3	5.2
93	0	0	10	0	0	0	16.7	4.1
94	0	0	0	10	0	0	16.7	4.1
95	0	10	10	0	0	10	50.0	5.5
96	0	10	0	0	0	0	16.7	4.1
97	0	0	10	10	0	0	33.3	5.2
98	0	0	0	10	0	0	16.7	4.1
99	0	10	0	10	10	10	66.7	5.2
100	0	0	10	0	0	0	16.7	4.1
101	0	10	10	0	0	10	50.0	5.5
102	0	0	10	10	10	10	66.7	5.2
103	0	0	0	10	0	0	16.7	4.1
104	0	0	0	0	0	0	0.0	0.0
105	0	10	0	0	0	0	16.7	4.1
106	0	10	0	0	0	0	16.7	4.1
107	0	0	10	0	0	0	16.7	4.1
108	0	0	0	0	10	10	33.3	5.2
109	0	0	0	0	0	10	16.7	4.1
110	0	0	0	0	0	0	0.0	0.0
111	10	0	10	10	0	0	50.0	5.5
112	10	10	10	10	0	0	66.7	5.2
113	0	10	10	10	0	10	66.7	5.2
114	0	0	10	0	10	0	33.3	5.2
115	0	0	0	10	0	0	16.7	4.1
116	10	10	0	0	10	10	66.7	5.2
117	10	0	0	10	0	0	33.3	5.2
118	10	0	10	10	0	10	66.7	5.2
119	10	10	0	0	0	0	33.3	5.2
120	0	0	0	0	0	0	0.0	0.0
121	0	0	0	0	0	0	0.0	0.0
122	10	10	10	0	0	10	66.7	5.2
123	0	0	0	0	0	10	16.7	4.1
124	0	10	10	0	0	0	33.3	5.2
125	10	0	0	10	0	0	33.3	5.2
126	10	10	0	0	0	10	50.0	5.5
127	0	10	0	0	0	10	33.3	5.2
128	0	0	0	0	0	10	16.7	4.1
129	10	10	10	10	0	0	66.7	5.2
130	0	0	0	10	0	0	16.7	4.1
131	0	0	0	0	0	0	0.0	0.0
132	0	0	10	0	0	0	16.7	4.1
133	0	0	10	10	0	0	33.3	5.2
134	0	0	10	0	0	0	16.7	4.1
135	0	0	10	0	0	0	16.7	4.1
136	10	0	0	10	10	10	66.7	5.2
137	0	0	0	0	0	0	0.0	0.0
138	10	0	0	10	10	10	66.7	5.2

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
139	0	0	0	0	0	10	16.7	4.1
140	0	0	0	10	10	0	33.3	5.2
141	0	0	0	0	0	0	0.0	0.0
142	0	0	0	0	0	0	0.0	0.0
143	0	10	0	10	0	0	33.3	5.2
144	0	0	0	10	0	0	16.7	4.1
145	10	0	10	10	0	0	50.0	5.5
146	10	0	0	0	0	0	16.7	4.1
147	10	0	0	10	0	0	33.3	5.2
148	0	10	10	10	0	0	50.0	5.5
149	0	10	10	0	0	10	50.0	5.5
150	0	0	0	10	10	0	33.3	5.2
151	0	0	10	0	0	0	16.7	4.1
152	0	10	0	0	10	10	50.0	5.5
153	10	0	10	10	0	10	66.7	5.2
154	0	0	0	10	10	0	33.3	5.2
155	0	10	0	10	0	0	33.3	5.2
156	0	10	10	10	0	0	50.0	5.5
157	10	0	10	10	10	0	66.7	5.2
158	0	0	0	10	0	0	16.7	4.1
159	10	10	10	10	10	0	83.3	4.1
160	10	10	10	0	0	10	66.7	5.2
161	0	10	10	10	10	0	66.7	5.2
162	10	10	10	0	10	10	83.3	4.1
163	0	10	10	0	0	10	50.0	5.5
164	10	0	10	10	10	0	66.7	5.2
165	0	0	0	10	0	10	33.3	5.2
166	0	10	10	10	0	10	66.7	5.2
167	10	0	10	10	10	10	83.3	4.1
168	0	10	10	10	0	10	66.7	5.2
169	0	0	10	0	10	0	33.3	5.2
170	10	0	0	0	0	10	33.3	5.2
171	0	0	10	0	0	0	16.7	4.1
172	10	0	10	10	10	0	66.7	5.2
173	10	0	10	10	0	0	50.0	5.5
174	10	0	10	10	10	10	83.3	4.1
175	0	0	10	10	0	10	50.0	5.5
176	0	0	10	10	0	10	50.0	5.5
177	0	0	10	10	10	10	66.7	5.2
178	10	10	10	0	10	0	66.7	5.2
179	0	0	0	0	0	10	16.7	4.1
180	10	10	0	10	0	0	50.0	5.5
181	10	10	10	0'	0	10	80.0	4.5
182	10	10	10	10	10	10	100.0	0.0
183	10	10	0	0	10	0	50.0	5.5
184	10	10	10	10	0	0	66.7	5.2
185	0	0	10	10	10	0	50.0	5.5
186	0	10	0	0	0	0	16.7	4.1
187	0	10	0	0	10	10	50.0	5.5
188	10	0	10	0	0	10	50.0	5.5

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
189	0	0	10	0	0	10	33.3	5.2
190	10	10	0	10	0	0	50.0	5.5
191	0	0	10	10	10	10	66.7	5.2
192	0	0	0	10	0	0	16.7	4.1
193	10	10	0	10	0	10	66.7	5.2
194	0	0	0	10	10	0	33.3	5.2
195	0	0	0	10	0	0	16.7	4.1
196	0	10	10	10	0	10	66.7	5.2
197	0	0	10	10	0	10	50.0	5.5
198	0	10	10	0	10	0	50.0	5.5
199	0	0	0	0	0	10	16.7	4.1
200	10	10	10	10	0	10	83.3	4.1
201	0	0	0	0	0	0	0.0	0.0
202	10	10	10	10	10	10	100.0	0.0
203	10	10	10	10	10	0	83.3	4.1
204	10	0	0	0	10	10	50.0	5.5
205	0	0	0	0	0	0	0.0	0.0
206	0	0	10	0	0	10	33.3	5.2
207	10	0	10	0	0	0	33.3	5.2
208	0	10	0	10	0	0	33.3	5.2
209	0	0	0	0	0	0	0.0	0.0
210	0	0	10	0	0	0	16.7	4.1
211	0	0	10	0	10	0	33.3	5.2
212	10	0	10	0	10	0	50.0	5.5
213	10	0	0	10	0	0	33.3	5.2
214	10	10	0	10	10	0	66.7	5.2
215	0	10	10	0	0	0	33.3	5.2
216	0	10	0	0	0	10	33.3	5.2
217	10	10	0	0	0	10	50.0	5.5
218	0	10	10	0	0	10	50.0	5.5
219	0	10	10	0	0	0	33.3	5.2
220	0	10	10	0	0	0	33.3	5.2
221	0	10	0	10	10	0	50.0	5.5
222	0	10	0	0	10	10	50.0	5.5
223	0	10	0	0	0	0	16.7	4.1
224	0	10	0	0	0	0	16.7	4.1
225	0	0	10	0	10	10	50.0	5.5
226	10	0	10	10	0	10	66.7	5.2
227	10	10	0	10	10	0	66.7	5.2
228	10	10	0	10	10	0	66.7	5.2
229	0	10	10	10	0	0	50.0	5.5
230	10	10	0	10	10	10	83.3	4.1
231	10	10	0	0	10	10	66.7	5.2
232	10	10	10	10	10	10	100.0	0.0
233	10	10	10	10	10	10	100.0	0.0
234	10	0	10	10	0	10	66.7	5.2
235	0	0	0	10	0	0	16.7	4.1
236	0	0	10	0	0	0	16.7	4.1
237	0	10	0	10	10	0	50.0	5.5
238	10	0	10	0	0	0	33.3	5.2

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
239	10	0	0	10	10	10	66.7	5.2
240	0	10	0	10	0	10	50.0	5.5
241	10	0	0	0	0	0	16.7	4.1
242	0	0	0	10	0	0	16.7	4.1
243	0	0	10	10	0	0	33.3	5.2
244	0	10	0	0	10	0	33.3	5.2
245	10	0	0	0	0	0	16.7	4.1
246	0	0	0	0	0	0	0.0	0.0
247	10	0	0	0	0	0	16.7	4.1
248	0	0	0	10	10	0	33.3	5.2
249	0	0	10	0	0	10	33.3	5.2
250	10	0	10	10	0	10	66.7	5.2
251	0	0	10	10	10	0	50.0	5.5
252	0	10	0	10	10	0	50.0	5.5
253	10	10	10	0	10	10	83.3	4.1
254	0	10	0	10	10	0	50.0	5.5
255	10	0	10	0	0	10	50.0	5.5
256	10	10	0	0	0	0	33.3	5.2
257	0	0	10	0	0	0	16.7	4.1
258	0	0	10	0	0	0	16.7	4.1
259	10	0	0	10	0	0	33.3	5.2
260	10	0	10	0	10	0	50.0	5.5
261	10	10	0	10	10	0	66.7	5.2
262	0	10	10	0	0	0	33.3	5.2
263	0	10	0	10	0	10	50.0	5.5
264	10	10	0	0	0	10	50.0	5.5
265	0	0	0	0	0	0	0.0	0.0
266	0	10	0	0	10	10	50.0	5.5
267	0	10	0	0	0	0	16.7	4.1
268	10	0	0	10	0	0	33.3	5.2
269	10	0	0	10	10	10	66.7	5.2
270	10	10	0	10	10	0	66.7	5.2
271	10	0	0	10	10	0	50.0	5.5
272	0	10	10	10	0	0	50.0	5.5
273	10	10	0	10	10	10	83.3	4.1
274	0	10	10	0	0	0	33.3	5.2
275	10	0	10	10	0	10	66.7	5.2
Means item	41.8	44.7	49.8	55.1	34.2	38.9	44.1	0.1
SD item	4.9	5.0	5.0	5.0	4.8	4.9		

Table 6.44. Data of 275 examinees grades in Group II (CR items), Physics Exam 1st Phase, 1st call, 2003.

	Group II (CR items)													
Student	1.1(6)	1.2(())	1.3(())	1.4(10)	1.5(())	2.1(9)	2.2(13)	2.3(())	3.1(14)	3.2(9)	3.3(5)	3.4(())	Means st	SD st
1	3	2	0	0	0	3	2	5	0	0	5	8	28.0	2.6
2	6	7	2	5	2	1	0	3	4	0	0	0	30.0	2.5
3	6	7	2	10	0	9	13	12	14	9	5	8	95.0	4.2
4	6	6	2	3	0	2	13	4	14	9	5	8	72.0	4.3
5	3	3	0	3	2	0	13	12	0	0	0	0	36.0	4.6
6	6	8	5	9	0	9	10	12	12	0	4	8	83.0	4.1
7	4	8	1	10	2	9	13	12	14	9	5	8	95.0	4.2
8	6	8	2	10	0	9	13	12	13	9	5	8	95.0	4.1
9	6	2	0	10	4	8	3	10	0	0	0	0	43.0	4.0
10	6	8	8	10	0	8	13	12	14	9	5	8	101.0	3.8
11	6	8	1	10	0	7	12	3	12	0	5	2	66.0	4.4
12	6	8	2	10	2	6	13	7	14	9	5	8	90.0	3.7
13	3	8	1	5	0	9	5	10	14	9	5	8	77.0	4.0
14	6	6	4	10	4	5	10	12	13	5	5	8	88.0	3.2
15	6	8	8	10	8	9	13	12	14	9	5	8	110.0	2.7
16	6	8	8	10	0	4	13	10	0	0	0	0	59.0	4.9
17	6	8	0	10	0	9	4	12	12	9	5	8	83.0	4.1
18	6	8	0	10	0	1	0	10	5	9	5	5	59.0	3.9
19	6	8	8	9	8	7	13	8	8	9	0	0	84.0	3.7
20	6	8	4	6	8	9	13	9	14	9	5	4	95.0	3.2
21	5	7	4	7	0	4	5	3	14	9	5	8	71.0	3.5
22	6	8	8	10	8	9	13	12	14	9	5	8	110.0	2.7
23	4	2	0	0	1	2	4	0	14	1	5	8	41.0	4.1
24	6	8	4	10	4	7	13	12	14	9	5	8	100.0	3.4
25	6	8	4	5	8	9	13	12	14	9	5	8	101.0	3.2
26	5	8	2	2	8	9	13	12	14	9	5	8	95.0	3.9

Group II (CR items)														
Student	1.1(6)	1.2(())	1.3(())	1.4(10)	1.5(())	2.1(9)	2.2(13)	2.3(())	3.1(14)	3.2(9)	3.3(5)	3.4(())	Means st	SD st
27	6	6	1	10	4	9	12	0	14	6	4	8	80.0	4.2
28	6	6	0	10	0	4	4	6	12	5	5	0	58.0	3.7
29	6	0	3	9	3	9	0	12	13	6	5	0	66.0	4.5
30	1	0	0	3	0	1	2	0	0	0	0	0	7.0	1.0
31	1	4	0	0	0	1	7	0	14	0	0	0	27.0	4.3
32	2	2	0	0	0	0	0	0	0	0	0	0	4.0	0.8
33	4	7	0	5	0	4	5	3	0	0	0	0	28.0	2.6
34	3	0	0	0	0	3	0	0	4	1	4	0	15.0	1.7
35	3	0	0	3	0	4	4	3	12	1	4	4	38.0	3.2
36	6	8	0	5	0	3	5	0	12	9	5	8	61.0	3.8
37	0	0	0	0	0	2	0	0	11	0	5	0	18.0	3.3
38	5	4	0	0	0	2	1	3	0	5	0	1	21.0	2.0
39	6	8	0	2	0	7	9	5	8	0	0	0	45.0	3.7
40	6	0	0	2	0	2	1	10	2	0	4	6	33.0	3.2
41	6	8	3	8	0	2	0	0	0	0	5	8	40.0	3.5
42	6	8	1	5	0	1	8	7	0	0	0	0	36.0	3.5
43	6	7	5	10	0	9	2	4	6	9	5	0	63.0	3.3
44	6	7	0	2	0	0	0	0	0	0	0	0	15.0	2.5
45	6	2	0	5	0	9	0	12	13	9	2	0	58.0	4.9
46	3	4	1	0	0	5	0	0	0	0	0	0	13.0	1.8
47	6	8	4	6	8	9	13	9	14	9	5	4	95.0	3.2
48	6	8	2	10	0	1	0	10	5	9	5	4	60.0	3.7
49	6	0	3	9	3	9	0	12	13	5	5	0	65.0	4.5
50	6	8	3	10	0	9	13	12	13	9	4	0	87.0	4.7
51	6	8	0	5	0	3	4	0	0	0	0	0	26.0	2.9
52	6	8	8	10	2	4	13	10	0	0	0	0	61.0	4.7
53	5	7	2	10	0	4	5	3	14	9	5	8	72.0	3.8
54	6	8	4	6	8	9	13	9	14	9	5	4	95.0	3.2
55	6	6	0	5	0	0	0	1	0	0	0	0	18.0	2.5
56	6	8	8	10	0	0	0	0	14	5	5	8	64.0	4.6

Group II (CR items)														
Student	1.1(6)	1.2(())	1.3(())	1.4(10)	1.5(())	2.1(9)	2.2(13)	2.3(())	3.1(14)	3.2(9)	3.3(5)	3.4(())	Means st	SD st
57	6	8	8	10	8	9	0	12	0	9	0	0	70.0	4.5
58	5	7	2	7	0	4	5	6	14	9	5	8	72.0	3.5
59	6	8	2	10	0	1	0	10	5	9	5	5	61.0	3.7
60	6	0	3	9	3	9	0	12	13	5	0	0	60.0	4.8
61	5	8	4	2	8	9	13	12	14	9	5	8	97.0	3.7
62	6	8	0	0	0	0	0	0	0	0	0	0	14.0	2.8
63	6	8	0	10	0	9	13	12	13	9	4	0	84.0	5.0
64	3	8	1	5	2	9	5	10	14	9	5	8	79.0	3.8
65	5	7	2	7	0	4	5	3	14	9	5	8	69.0	3.6
66	6	8	8	10	8	9	8	12	0	0	0	0	69.0	4.5
67	3	8	2	5	0	9	13	5	12	5	5	8	75.0	3.9
68	6	6	8	10	6	4	6	10	13	5	5	0	79.0	3.3
69	6	8	8	10	8	8	13	12	14	9	5	5	106.0	2.9
70	6	8	8	9	8	7	13	10	8	9	5	8	99.0	2.0
71	6	8	1	7	2	9	13	12	2	9	5	8	82.0	3.8
72	6	6	0	2	0	2	4	0	12	0	0	0	32.0	3.7
73	3	4	2	2	0	5	0	0	0	0	0	0	16.0	1.8
74	6	8	8	10	2	8	4	0	14	5	5	8	78.0	3.7
75	5	4	2	2	0	2	0	0	1	5	4	0	25.0	2.0
76	5	8	0	10	0	0	0	0	0	0	0	0	23.0	3.6
77	6	4	8	10	4	9	8	10	0	0	0	0	59.0	4.1
78	2	8	2	7	0	1	4	2	8	0	5	6	45.0	3.0
79	6	8	8	10	2	3	4	0	0	0	0	0	41.0	3.7
80	3	6	1	9	0	0	0	0	0	0	0	0	19.0	3.0
81	5	7	2	7	0	4	5	2	14	9	4	8	67.0	3.8
82	6	8	2	10	0	1	0	10	5	9	5	0	56.0	4.0
83	6	6	4	10	4	5	10	12	13	5	5	8	88.0	3.2
84	6	8	2	4	0	3	4	0	0	0	0	0	27.0	2.8
85	0	0	0	0	0	4	0	9	0	0	0	0	13.0	2.7
86	6	8	0	10	4	4	0	0	8	9	5	7	61.0	3.6

Group II (CR items)														
Student	1.1(6)	1.2(())	1.3(())	1.4(10)	1.5(())	2.1(9)	2.2(13)	2.3(())	3.1(14)	3.2(9)	3.3(5)	3.4(())	Means st	SD st
87	6	8	4	10	0	7	13	7	14	8	4	8	89.0	3.8
88	6	8	2	0	0	7	7	10	11	0	0	5	56.0	4.1
89	6	6	5	9	8	5	0	12	9	9	5	8	82.0	3.0
90	6	8	0	10	0	9	13	12	12	7	5	8	90.0	4.3
91	6	8	8	10	0	6	3	11	14	9	5	0	80.0	4.2
92	6	6	2	10	2	7	13	12	14	0	5	8	85.0	4.5
93	6	0	2	0	1	9	0	11	14	9	5	0	57.0	5.0
94	0	0	0	0	2	1	0	0	0	0	0	0	3.0	0.6
95	6	6	7	5	2	6	12	7	4	4	5	0	64.0	2.9
96	6	0	2	2	1	9	0	11	14	8	0	0	53.0	5.0
97	6	8	0	0	4	5	0	0	8	9	5	4	49.0	3.4
98	1	2	4	10	7	8	5	5	4	0	0	0	46.0	3.4
99	3	4	2	2	2	7	5	3	4	5	5	8	50.0	1.9
100	0	0	3	5	3	3	8	10	10	5	1	0	48.0	3.7
101	6	8	7	10	3	8	0	0	12	9	4	8	75.0	3.8
102	6	8	7	7	4	9	12	12	12	4	5	8	94.0	2.9
103	5	8	5	0	5	6	0	7	5	4	0	0	45.0	3.0
104	1	5	0	8	0	0	10	3	4	4	0	0	35.0	3.4
105	6	8	0	2	4	5	13	7	12	0	5	0	62.0	4.4
106	6	8	6	10	0	5	11	12	14	4	5	8	89.0	3.9
107	6	0	2	1	0	5	13	7	14	9	5	4	66.0	4.7
108	6	8	2	0	0	5	13	12	14	0	5	8	73.0	5.1
109	0	0	0	6	0	3	0	0	12	3	5	0	29.0	3.7
110	0	0	2	10	0	0	0	1	12	0	4	0	29.0	4.2
111	2	5	0	10	0	2	11	0	12	1	5	0	48.0	4.6
112	6	8	7	0	0	9	13	10	13	0	5	8	79.0	4.6
113	6	8	0	9	2	0	13	3	14	9	5	6	75.0	4.6
114	6	8	0	5	0	0	13	0	13	0	0	7	52.0	5.1
115	6	5	0	3	0	1	2	10	0	0	2	5	34.0	3.1
116	6	8	0	10	4	5	13	1	14	9	4	8	82.0	4.3

Group II (CR items)														
Student	1.1(6)	1.2(())	1.3(())	1.4(10)	1.5(())	2.1(9)	2.2(13)	2.3(())	3.1(14)	3.2(9)	3.3(5)	3.4(())	Means st	SD st
117	6	8	0	3	0	9	0	1	2	0	0	0	29.0	3.4
118	6	8	8	10	8	9	13	12	14	9	5	8	110.0	2.7
119	6	8	5	7	6	9	13	12	14	9	5	8	102.0	3.1
120	6	8	5	10	4	7	10	0	12	9	5	0	76.0	3.8
121	6	0	0	8	0	5	2	8	12	1	5	4	51.0	3.8
122	6	8	6	10	0	7	13	12	14	9	5	8	98.0	3.9
123	3	8	0	10	0	2	4	0	12	5	5	8	57.0	4.0
124	0	4	2	0	2	5	2	3	0	0	0	0	18.0	1.8
125	0	0	1	2	2	7	13	3	12	0	4	7	51.0	4.6
126	6	6	5	8	2	9	2	12	12	9	5	8	84.0	3.3
127	0	6	0	0	7	0	0	2	7	0	4	0	26.0	3.0
128	2	0	0	10	2	6	5	12	13	0	5	0	55.0	4.8
129	6	6	0	5	2	0	8	0	14	0	5	0	46.0	4.4
130	3	8	0	10	2	3	0	0	14	4	5	8	57.0	4.4
131	6	8	8	8	0	6	2	2	12	9	0	0	61.0	4.1
132	3	0	0	10	0	3	6	12	5	4	5	0	48.0	4.0
133	6	8	0	10	0	0	13	0	12	0	4	0	53.0	5.2
134	6	8	0	5	0	9	13	9	2	0	5	6	63.0	4.2
135	0	2	2	8	0	3	7	3	0	0	0	6	31.0	2.9
136	6	8	0	9	0	7	13	12	14	5	4	8	86.0	4.5
137	0	0	0	0	0	2	1	0	14	5	5	0	27.0	4.2
138	6	8	6	6	0	9	11	12	14	8	5	7	92.0	3.7
139	0	2	3	0	2	5	2	0	2	8	5	0	29.0	2.5
140	6	7	3	5	0	3	2	7	1	0	0	0	34.0	2.8
141	2	2	0	0	0	5	2	0	0	3	6	0	20.0	2.1
142	6	0	0	2	0	3	3	0	14	0	0	0	28.0	4.1
143	3	6	0	8	0	3	3	3	0	0	5	8	39.0	3.0
144	2	0	0	8	0	3	0	12	1	0	5	6	37.0	3.9
145	6	8	0	7	0	9	5	0	14	9	5	0	63.0	4.5
146	0	5	0	0	2	0	0	0	0	0	0	0	7.0	1.5

Group II (CR items)														
Student	1.1(6)	1.2(())	1.3(())	1.4(10)	1.5(())	2.1(9)	2.2(13)	2.3(())	3.1(14)	3.2(9)	3.3(5)	3.4(())	Means st	SD st
147	3	5	2	5	2	2	2	0	1	0	3	4	29.0	1.7
148	6	8	6	9	3	5	0	4	3	8	3	0	55.0	3.0
149	6	8	0	1	0	5	0	0	0	0	5	0	25.0	3.0
150	6	8	2	2	0	5	0	0	0	0	0	0	23.0	2.8
151	6	8	0	8	0	5	0	0	1	0	4	4	36.0	3.2
152	6	7	0	3	0	2	0	0	1	0	5	0	24.0	2.6
153	6	8	6	10	0	5	3	12	1	0	4	0	55.0	4.0
154	3	6	1	5	2	8	2	7	13	8	0	0	55.0	4.0
155	3	7	0	0	1	5	0	12	14	9	0	0	51.0	5.1
156	3	0	0	9	0	9	13	10	13	9	1	2	69.0	5.2
157	6	8	0	8	0	7	0	12	13	5	5	2	66.0	4.4
158	5	8	3	5	0	2	11	8	13	9	4	8	76.0	3.8
159	6	8	2	10	6	7	12	12	13	9	5	2	92.0	3.7
160	4	8	0	8	0	5	13	12	5	1	5	4	65.0	4.2
161	6	8	3	10	5	7	13	12	13	8	5	8	98.0	3.3
162	6	8	6	10	8	7	12	12	13	9	5	2	98.0	3.2
163	3	7	2	10	0	5	5	1	13	8	4	0	58.0	4.1
164	0	0	0	0	0	9	0	12	6	8	5	0	40.0	4.4
165	6	8	0	10	0	7	13	3	13	8	2	5	75.0	4.5
166	6	8	4	10	8	9	13	12	12	8	5	7	102.0	2.8
167	6	8	8	10	8	7	13	12	13	9	5	8	107.0	2.6
168	6	8	3	2	8	9	13	9	14	7	5	6	90.0	3.6
169	5	8	3	10	0	7	7	12	14	9	5	8	88.0	3.8
170	3	0	0	3	0	1	11	0	12	8	5	2	45.0	4.4
171	5	8	2	10	6	3	2	0	12	9	5	0	62.0	4.0
172	6	7	0	3	1	9	13	12	13	9	5	8	86.0	4.4
173	6	8	2	10	1	7	3	12	12	9	4	0	74.0	4.2
174	6	8	8	1	6	9	10	12	13	8	5	7	93.0	3.2
175	3	8	0	10	0	2	11	12	6	0	2	0	54.0	4.7
176	6	8	8	8	8	9	5	12	12	9	5	2	92.0	2.9

Group II (CR items)														
Student	1.1(6)	1.2(())	1.3(())	1.4(10)	1.5(())	2.1(9)	2.2(13)	2.3(())	3.1(14)	3.2(9)	3.3(5)	3.4(())	Means st	SD st
177	5	8	4	10	3	6	13	0	7	9	3	3	71.0	3.7
178	2	2	4	10	2	9	8	10	14	8	5	5	79.0	3.8
179	3	1	2	5	6	7	10	3	6	5	5	1	54.0	2.6
180	3	0	0	0	0	6	12	0	0	5	5	2	33.0	3.7
181	3	3	2	5	8	6	9	0	0	0	5	4	45.0	3.0
182	6	8	8	5	4	4	10	0	6	1	0	0	52.0	3.5
183	3	0	2	0	0	6	10	0	0	5	5	2	33.0	3.2
184	6	8	8	5	0	9	9	3	3	5	0	2	58.0	3.3
185	0	1	2	0	0	4	5	3	1	5	0	2	23.0	1.9
186	3	8	7	10	8	9	10	12	2	3	3	0	75.0	3.9
187	1	8	0	0	0	8	2	0	0	0	0	0	19.0	3.1
188	6	8	0	10	0	7	13	11	12	0	4	8	79.0	4.7
189	6	8	0	10	0	9	13	12	14	2	5	8	87.0	4.8
190	3	0	2	0	8	8	8	12	14	9	5	8	77.0	4.5
191	6	8	0	10	8	9	13	12	14	9	5	8	102.0	3.8
192	6	7	0	9	1	5	7	9	10	9	1	8	72.0	3.5
193	3	3	8	7	0	0	0	12	14	8	5	0	60.0	4.9
194	6	8	2	10	3	9	0	12	12	9	5	8	84.0	3.9
195	6	8	4	4	0	4	5	4	14	9	4	8	70.0	3.5
196	4	4	2	5	0	7	13	12	13	0	5	8	73.0	4.6
197	6	8	8	10	8	9	13	12	6	0	4	2	86.0	3.8
198	6	7	4	2	0	7	13	12	11	1	5	4	72.0	4.2
199	4	4	2	1	0	7	7	1	0	0	5	4	35.0	2.6
200	3	4	0	7	8	5	5	11	14	7	5	1	70.0	4.0
201	6	8	2	10	2	6	13	12	11	9	5	8	92.0	3.6
202	6	8	7	10	6	9	13	12	14	9	5	8	107.0	2.9
203	6	8	2	10	5	8	13	11	14	9	4	8	98.0	3.6
204	6	8	4	4	2	8	13	5	12	9	5	8	84.0	3.3
205	3	0	0	0	0	0	0	2	0	0	0	0	5.0	1.0
206	2	0	0	0	2	0	5	0	2	0	5	0	16.0	1.9

Group II (CR items)														
Student	1.1(6)	1.2(())	1.3(())	1.4(10)	1.5(())	2.1(9)	2.2(13)	2.3(())	3.1(14)	3.2(9)	3.3(5)	3.4(())	Means st	SD st
207	6	0	0	5	2	0	0	0	0	0	4	0	17.0	2.3
208	6	2	0	0	2	3	2	0	0	4	4	0	23.0	2.0
209	6	8	8	0	0	7	2	3	5	5	0	0	44.0	3.2
210	6	8	0	5	0	9	13	9	2	0	5	6	63.0	4.2
211	0	2	2	8	0	5	7	12	4	5	5	6	56.0	3.4
212	6	8	0	8	0	2	5	0	14	5	5	0	53.0	4.3
213	6	8	6	6	0	9	5	7	4	8	5	7	71.0	2.4
214	6	3	0	7	0	3	5	12	14	3	0	0	53.0	4.7
215	2	3	0	0	3	5	0	0	3	0	4	0	20.0	1.9
216	3	5	2	0	0	5	0	0	3	0	4	0	22.0	2.1
217	2	3	2	1	0	3	3	0	1	0	4	0	19.0	1.4
218	6	8	0	1	0	5	0	0	0	0	5	0	25.0	3.0
219	6	6	0	1	0	3	0	11	5	8	4	0	44.0	3.7
220	6	8	0	8	0	5	0	11	1	0	5	4	48.0	3.8
221	3	7	6	5	0	5	3	7	13	0	4	0	53.0	3.7
222	6	3	0	3	0	0	0	0	1	0	0	0	13.0	1.9
223	4	3	0	0	0	5	0	0	1	3	0	0	16.0	1.9
224	2	3	0	0	2	5	2	0	1	0	0	0	15.0	1.6
225	3	7	0	8	0	3	5	7	4	3	5	6	51.0	2.6
226	6	8	3	0	2	5	2	11	3	8	5	0	53.0	3.4
227	6	7	3	5	1	3	2	12	5	8	4	0	56.0	3.3
228	3	6	0	8	1	3	3	11	13	0	5	8	61.0	4.2
229	6	6	6	8	0	3	5	12	5	8	5	8	72.0	3.0
230	6	5	6	7	2	3	5	12	14	8	3	8	79.0	3.6
231	6	8	6	8	3	8	13	11	13	9	4	8	97.0	3.1
232	6	8	8	7	8	9	13	12	14	8	5	8	106.0	2.8
233	6	8	6	5	2	5	5	12	14	8	5	9	85.0	3.3
234	6	8	6	10	0	5	3	12	1	0	4	6	61.0	3.8
235	3	3	3	0	1	0	2	0	1	0	4	0	17.0	1.5
236	0	0	0	0	0	3	0	0	1	1	5	0	10.0	1.6

Group II (CR items)														
Student	1.1(6)	1.2(())	1.3(())	1.4(10)	1.5(())	2.1(9)	2.2(13)	2.3(())	3.1(14)	3.2(9)	3.3(5)	3.4(())	Means st	SD st
237	2	7	0	9	0	3	0	0	0	3	0	0	24.0	3.1
238	6	7	2	2	2	5	4	8	12	5	4	6	63.0	2.9
239	6	8	0	10	0	2	0	3	0	0	0	0	29.0	3.6
240	1	3	0	0	0	2	10	3	9	0	2	0	30.0	3.5
241	3	0	1	0	0	1	10	12	2	0	1	0	30.0	4.1
242	6	8	2	2	0	4	0	12	0	0	2	0	36.0	3.9
243	6	0	5	0	0	5	8	4	0	0	0	2	30.0	2.9
244	5	0	0	4	0	5	0	9	13	0	4	8	48.0	4.3
245	6	8	0	10	0	5	2	0	0	0	5	7	43.0	3.7
246	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
247	0	0	0	0	0	2	2	2	7	0	4	8	25.0	2.8
248	6	8	0	10	0	8	9	0	12	5	5	8	71.0	4.1
249	3	6	1	5	0	5	12	8	14	7	5	8	74.0	4.1
250	6	4	2	10	0	5	5	0	12	0	5	8	57.0	3.9
251	6	8	8	10	0	0	5	2	14	9	5	8	75.0	4.2
252	3	5	2	2	2	9	11	6	14	0	5	8	67.0	4.2
253	0	8	3	7	0	5	3	3	12	8	5	4	58.0	3.5
254	5	8	2	3	2	1	2	12	0	0	5	8	48.0	3.7
255	1	7	0	1	0	1	0	6	12	1	0	8	37.0	4.1
256	3	3	0	0	2	9	0	1	10	0	0	0	28.0	3.6
257	6	8	0	5	0	9	13	9	2	0	5	0	57.0	4.4
258	3	7	0	8	0	3	5	7	4	3	5	6	51.0	2.6
259	6	3	0	5	0	3	0	0	4	5	4	0	30.0	2.4
260	6	6	3	3	0	9	5	3	2	3	0	0	40.0	2.8
261	6	7	3	5	1	3	2	12	5	8	4	0	56.0	3.3
262	3	3	0	0	3	5	0	0	3	0	4	0	21.0	1.9
263	3	5	2	0	0	5	0	0	3	0	4	0	22.0	2.1
264	2	3	2	1	0	3	3	0	1	0	4	0	19.0	1.4
265	3	3	0	0	0	0	2	0	0	0	0	0	8.0	1.2
266	6	3	0	3	0	0	3	0	1	0	0	0	16.0	2.0

Group II (CR items)														
Student	1.1(6)	1.2(())	1.3(())	1.4(10)	1.5(())	2.1(9)	2.2(13)	2.3(())	3.1(14)	3.2(9)	3.3(5)	3.4(())	Means st	SD st
267	3	3	3	0	2	0	0	0	0	0	0	0	11.0	1.4
268	6	8	6	6	0	9	5	7	4	8	4	7	70.0	2.4
269	2	5	0	2	0	5	2	0	4	3	6	0	29.0	2.2
270	6	3	0	7	0	3	5	12	13	3	0	0	52.0	4.5
271	3	6	0	8	1	3	3	11	13	0	5	8	61.0	4.2
272	6	6	6	8	0	3	5	12	5	8	5	8	72.0	3.0
273	6	5	6	7	2	3	5	12	5	8	3	8	70.0	2.7
274	6	8	2	8	0	5	0	11	1	0	5	4	50.0	3.7
275	6	8	6	10	0	0	3	12	1	0	4	6	56.0	4.1
Means item	4.6	5.7	2.4	5.7	1.7	5.0	5.9	6.3	7.8	4.2	3.5	3.6	56.4	1.7
SD item	2.0	2.9	2.7	3.9	2.6	3.0	5.1	5.1	5.7	3.9	2.1	3.6		

Table 6.45. Data of 275 examinees grades in Group III (lab CR items), Physics Exam 1st Phase, 1st call, 2003.

	Group III (CR items)							
Student	1.1(3)	1.2(4)	2.1(4)	2.2(6)	3(4)	4(9)	Means st	SD st
1	3	3	4	0	0	2	12.0	1.7
2	0	2	0	0	3	0	5.0	1.3
3	3	4	6	4	4	9	30.0	2.2
4	3	3	0	0	0	0	6.0	1.5
5	0	2	2	0	0	0	4.0	1.0
6	0	3	0	2	0	0	5.0	1.3
7	3	4	3	6	4	2	22.0	1.4
8	3	4	4	6	4	9	30.0	2.2
9	3	3	3	6	4	3	22.0	1.2
10	0	3	4	6	4	0	17.0	2.4
11	0	3	4	5	3	0	15.0	2.1
12	3	3	2	6	2	3	19.0	1.5
13	3	4	0	6	4	1	18.0	2.2
14	3	2	1	0	4	2	12.0	1.4
15	3	4	4	6	4	9	30.0	2.2
16	3	2	3	3	0	0	11.0	1.5
17	3	2	3	6	4	7	25.0	1.9
18	2	2	6	4	3	0	17.0	2.0
19	3	4	4	6	3	8	28.0	2.0
20	3	2	3	5	4	3	20.0	1.0
21	3	2	3	6	4	2	20.0	1.5
22	3	4	4	6	4	7	28.0	1.5
23	0	2	0	6	4	2	14.0	2.3
24	3	4	4	6	4	8	29.0	1.8
25	3	4	4	6	4	7	28.0	1.5
26	0	2	4	4	4	7	21.0	2.3
27	2	0	4	6	2	5	19.0	2.2
28	0	4	0	2	0	0	6.0	1.7
29	0	0	0	0	0	0	0.0	0.0
30	0	0	0	0	0	0	0.0	0.0
31	0	2	1	3	0	0	6.0	1.3
32	0	4	0	0	0	0	4.0	1.6
33	0	0	0	0	0	0	0.0	0.0
34	0	4	0	0	0	0	4.0	1.6
35	0	0	0	0	0	0	0.0	0.0
36	1	0	0	0	0	0	1.0	0.4
37	0	0	0	0	0	0	0.0	0.0
38	0	2	2	2	3	0	9.0	1.2
39	4	0	0	6	4	0	14.0	2.7
40	0	2	0	0	0	1	3.0	0.8
41	0	0	0	0	0	0	0.0	0.0
42	0	0	0	0	0	0	0.0	0.0
43	3	3	0	3	4	0	13.0	1.7
44	0	0	0	0	0	0	0.0	0.0
45	0	3	4	6	4	2	19.0	2.0
46	0	0	0	4	0	0	4.0	1.6

Group III (CR items)								
Student	1.1(3)	1.2(4)	2.1(4)	2.2(6)	3(4)	4(9)	Means st	SD st
47	3	2	4	5	4	3	21.0	1.0
48	2	2	6	4	3	0	17.0	2.0
49	0	0	0	0	0	0	0.0	0.0
50	0	2	2	0	0	0	4.0	1.0
51	0	2	2	0	4	2	10.0	1.5
52	3	2	2	3	0	0	10.0	1.4
53	3	2	2	6	4	2	19.0	1.6
54	3	2	3	5	4	3	20.0	1.0
55	1	3	1	0	2	0	7.0	1.2
56	0	2	3	6	3	4	18.0	2.0
57	0	2	0	0	0	0	2.0	0.8
58	3	2	2	6	4	2	19.0	1.6
59	2	2	1	4	3	0	12.0	1.4
60	0	0	0	0	0	0	0.0	0.0
61	3	2	4	3	4	7	23.0	1.7
62	0	0	0	0	0	0	0.0	0.0
63	0	0	0	0	0	0	0.0	0.0
64	3	4	0	6	4	1	18.0	2.2
65	3	2	2	6	4	1	18.0	1.8
66	0	1	0	0	0	0	1.0	0.4
67	2	2	4	6	4	2	20.0	1.6
68	0	4	0	2	0	0	6.0	1.7
69	3	4	4	6	4	8	29.0	1.8
70	3	4	4	6	3	8	28.0	2.0
71	2	3	2	5	3	8	23.0	2.3
72	0	2	2	0	0	0	4.0	1.0
73	0	1	0	4	0	0	5.0	1.6
74	3	4	4	6	3	4	24.0	1.1
75	0	1	2	6	3	3	15.0	2.1
76	0	0	0	0	0	0	0.0	0.0
77	0	1	0	0	0	0	1.0	0.4
78	0	2	0	2	3	3	10.0	1.4
79	3	4	2	0	4	2	15.0	1.5
80	0	0	0	0	0	0	0.0	0.0
81	3	4	2	6	4	3	22.0	1.4
82	2	2	6	4	3	2	19.0	1.6
83	3	2	0	4	3	2	14.0	1.4
84	0	2	4	6	4	2	18.0	2.1
85	0	0	2	0	0	0	2.0	0.8
86	0	2	0	5	0	0	7.0	2.0
87	3	2	4	6	4	3	22.0	1.4
88	0	0	0	0	0	0	0.0	0.0
89	3	0	0	0	0	0	3.0	1.2
90	3	3	2	1	0	0	9.0	1.4
91	0	0	0	0	4	7	11.0	3.0
92	3	4	4	6	4	0	21.0	2.0
93	3	2	2	4	3	0	14.0	1.4
94	0	0	0	0	3	0	3.0	1.2
95	3	4	2	4	2	2	17.0	1.0
96	3	2	2	4	3	0	14.0	1.4

Group III (CR items)								
Student	1.1(3)	1.2(4)	2.1(4)	2.2(6)	3(4)	4(9)	Means st	SD st
97	0	2	0	4	0	0	6.0	1.7
98	0	2	1	0	0	0	3.0	0.8
99	3	3	4	2	2	4	18.0	0.9
100	3	3	1	2	0	0	9.0	1.4
101	3	4	4	5	4	4	24.0	0.6
102	3	4	4	6	4	4	25.0	1.0
103	0	0	0	0	0	0	0.0	0.0
104	0	1	4	6	4	2	17.0	2.2
105	0	3	4	5	3	3	18.0	1.7
106	0	0	0	5	2	2	9.0	2.0
107	3	4	2	1	0	0	10.0	1.6
108	0	0	0	0	0	0	0.0	0.0
109	0	3	0	2	3	0	8.0	1.5
110	0	0	0	0	0	0	0.0	0.0
111	0	0	0	5	3	0	8.0	2.2
112	0	2	4	5	4	5	20.0	2.0
113	2	4	2	5	3	4	20.0	1.2
114	0	2	0	4	3	7	16.0	2.7
115	0	0	1	0	0	0	1.0	0.4
116	0	0	5	3	5	0	13.0	2.5
117	0	2	4	4	0	0	10.0	2.0
118	3	2	4	5	3	1	18.0	1.4
119	3	4	0	5	3	9	24.0	3.0
120	0	0	4	6	3	7	20.0	2.9
121	0	0	4	3	1	9	17.0	3.4
122	3	4	4	6	4	7	28.0	1.5
123	0	2	2	0	0	0	4.0	1.0
124	0	2	4	3	3	9	21.0	3.0
125	3	4	4	6	2	5	24.0	1.4
126	3	2	4	3	4	5	21.0	1.0
127	0	0	0	0	0	0	0.0	0.0
128	0	0	0	0	0	0	0.0	0.0
129	0	2	4	3	4	2	15.0	1.5
130	0	2	2	0	0	0	4.0	1.0
131	0	2	4	6	2	3	17.0	2.0
132	3	2	4	5	0	0	14.0	2.1
133	3	2	3	6	3	5	22.0	1.5
134	0	2	2	3	0	0	7.0	1.3
135	0	4	0	6	3	1	14.0	2.4
136	0	2	4	6	4	3	19.0	2.0
137	0	2	3	6	3	0	14.0	2.3
138	0	4	2	4	4	9	23.0	3.0
139	0	0	0	0	0	0	0.0	0.0
140	3	2	0	1	0	0	6.0	1.3
141	0	0	0	4	3	2	9.0	1.8
142	0	0	0	0	0	0	0.0	0.0
143	0	0	0	6	0	0	6.0	2.4
144	3	4	0	5	4	4	20.0	1.8
145	2	2	2	3	4	2	15.0	0.8
146	0	0	0	0	2	0	2.0	0.8

Group III (CR items)								
Student	1.1(3)	1.2(4)	2.1(4)	2.2(6)	3(4)	4(9)	Means st	SD st
147	0	0	0	0	0	0	0.0	0.0
148	0	0	0	0	0	0	0.0	0.0
149	0	2	4	6	4	0	16.0	2.4
150	0	4	0	4	3	2	13.0	1.8
151	0	2	2	0	0	0	4.0	1.0
152	0	4	0	6	3	0	13.0	2.6
153	3	4	4	6	4	9	30.0	2.2
154	0	0	0	3	3	4	10.0	1.9
155	0	2	2	0	0	0	4.0	1.0
156	0	0	0	6	0	0	6.0	2.4
157	0	3	4	5	4	3	19.0	1.7
158	0	3	0	6	0	0	9.0	2.5
159	3	4	4	5	3	8	27.0	1.9
160	0	0	0	0	0	0	0.0	0.0
161	2	3	4	5	4	9	27.0	2.4
162	0	0	4	5	3	3	15.0	2.1
163	0	3	0	4	0	0	7.0	1.8
164	3	3	0	0	0	3	9.0	1.6
165	3	3	3	4	3	4	20.0	0.5
166	3	0	0	0	0	0	3.0	1.2
167	3	4	4	5	4	9	29.0	2.1
168	3	3	3	5	4	5	23.0	1.0
169	3	3	4	5	3	5	23.0	1.0
170	2	0	0	5	4	0	11.0	2.2
171	0	0	0	1	4	0	5.0	1.6
172	3	0	1	0	0	0	4.0	1.2
173	3	3	2	5	1	3	17.0	1.3
174	3	3	3	5	4	5	23.0	1.0
175	3	0	0	0	0	0	3.0	1.2
176	3	2	3	4	4	3	19.0	0.8
177	3	2	0	0	0	0	5.0	1.3
178	1	4	0	6	4	5	20.0	2.3
179	2	3	4	5	2	5	21.0	1.4
180	3	3	4	5	2	3	20.0	1.0
181	3	3	4	0	2	3	15.0	1.4
182	3	4	4	0	0	0	11.0	2.0
183	3	3	4	5	2	3	20.0	1.0
184	3	4	4	6	4	3	24.0	1.1
185	0	0	0	0	0	0	0.0	0.0
186	0	3	0	6	4	0	13.0	2.6
187	0	1	5	0	0	0	6.0	2.0
188	0	3	4	0	0	0	7.0	1.8
189	2	3	4	4	4	1	18.0	1.3
190	3	4	1	0	0	0	8.0	1.8
191	1	3	4	0	0	0	8.0	1.8
192	1	0	1	0	1	0	3.0	0.5
193	0	4	0	0	1	0	5.0	1.6
194	3	3	4	1	0	0	11.0	1.7
195	1	3	4	5	3	0	16.0	1.9
196	3	4	1	5	4	9	26.0	2.7

Group III (CR items)								
Student	1.1(3)	1.2(4)	2.1(4)	2.2(6)	3(4)	4(9)	Means st	SD st
197	3	4	4	6	4	3	24.0	1.1
198	3	1	1	1	2	0	8.0	1.0
199	0	3	4	1	0	2	10.0	1.6
200	0	4	1	6	3	5	19.0	2.3
201	1	4	4	3	4	1	17.0	1.5
202	1	3	1	6	4	7	22.0	2.5
203	0	0	2	6	0	2	10.0	2.3
204	3	3	4	5	3	3	21.0	0.8
205	0	0	0	0	0	0	0.0	0.0
206	3	0	0	0	0	0	3.0	1.2
207	2	2	0	0	0	0	4.0	1.0
208	0	2	2	0	0	0	4.0	1.0
209	0	2	4	6	2	3	17.0	2.0
210	0	2	2	3	0	0	7.0	1.3
211	0	4	2	6	3	1	16.0	2.2
212	0	2	3	6	3	0	14.0	2.3
213	0	2	2	4	2	0	10.0	1.5
214	2	4	3	6	4	0	19.0	2.0
215	0	0	0	0	0	0	0.0	0.0
216	1	2	3	0	0	0	6.0	1.3
217	0	4	2	0	0	0	6.0	1.7
218	0	2	4	6	4	0	16.0	2.4
219	0	0	3	5	3	0	11.0	2.1
220	3	4	2	6	2	0	17.0	2.0
221	0	2	4	5	3	0	14.0	2.1
222	0	0	0	0	0	0	0.0	0.0
223	3	2	2	3	4	0	14.0	1.4
224	0	0	0	0	0	0	0.0	0.0
225	0	2	4	6	2	0	14.0	2.3
226	0	4	2	1	2	0	9.0	1.5
227	3	2	2	4	0	0	11.0	1.6
228	0	2	3	6	3	0	14.0	2.3
229	3	4	0	5	4	4	20.0	1.8
230	0	4	4	6	4	0	18.0	2.4
231	1	4	4	6	4	9	28.0	2.7
232	3	4	4	6	4	9	30.0	2.2
233	3	4	4	6	4	9	30.0	2.2
234	3	4	4	6	4	9	30.0	2.2
235	0	2	2	0	3	4	11.0	1.6
236	0	0	0	0	0	3	3.0	1.2
237	0	2	0	2	0	0	4.0	1.0
238	2	3	4	6	4	5	24.0	1.4
239	0	0	0	0	0	0	0.0	0.0
240	0	2	0	5	3	0	10.0	2.1
241	3	2	0	0	0	3	8.0	1.5
242	0	0	0	0	0	0	0.0	0.0
243	3	0	2	0	0	0	5.0	1.3
244	0	2	1	0	4	0	7.0	1.6
245	0	3	0	5	4	0	12.0	2.3
246	0	0	4	4	0	0	8.0	2.1

Group III (CR items)								
Student	1.1(3)	1.2(4)	2.1(4)	2.2(6)	3(4)	4(9)	Means st	SD st
247	0	0	3	0	0	3	6.0	1.5
248	0	3	0	5	1	0	9.0	2.1
249	2	2	0	6	4	3	17.0	2.0
250	3	1	4	0	0	0	8.0	1.8
251	3	2	4	5	2	5	21.0	1.4
252	2	0	0	6	3	9	20.0	3.6
253	3	3	4	6	2	3	21.0	1.4
254	0	0	0	5	3	3	11.0	2.1
255	0	1	0	5	2	3	11.0	1.9
256	0	0	0	0	0	0	0.0	0.0
257	0	2	2	4	0	0	8.0	1.6
258	0	2	4	6	2	0	14.0	2.3
259	0	2	4	6	4	3	19.0	2.0
260	0	0	0	0	0	0	0.0	0.0
261	3	2	2	4	0	0	11.0	1.6
262	0	0	0	0	0	0	0.0	0.0
263	1	2	3	0	0	0	6.0	1.3
264	0	4	2	0	0	0	6.0	1.7
265	0	0	0	0	0	0	0.0	0.0
266	0	0	0	0	0	0	0.0	0.0
267	0	2	0	0	0	0	2.0	0.8
268	0	2	2	4	2	0	10.0	1.5
269	0	0	0	4	3	2	9.0	1.8
270	2	4	3	6	4	0	19.0	2.0
271	0	2	3	6	3	0	14.0	2.3
272	3	4	0	4	4	0	15.0	2.0
273	0	2	4	1	2	0	9.0	1.5
274	3	4	2	6	4	0	19.0	2.0
275	3	4	4	6	4	9	30.0	2.2
Means item	1.2	2.0	1.9	3.1	2.0	1.9	12.3	0.6
SD item	1.4	1.5	1.8	2.5	1.7	2.8		

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Table 6.46. Data of 251 examinees grades in Group I (MC items), Physics Exam 1st Phase, 2004.

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
1	10	10	10	10	0	10	83.3	4.1
2	10	10	10	10	0	0	66.7	5.2
3	0	0	0	0	10	0	16.7	4.1
4	10	10	10	10	10	0	83.3	4.1
5	10	0	10	0	10	0	50.0	5.5
6	10	10	0	10	10	10	83.3	4.1
7	0	10	0	0	10	10	50.0	5.5
8	0	10	10	10	10	10	83.3	4.1
9	10	0	10	0	0	0	33.3	5.2
10	0	10	0	10	10	0	50.0	5.5
11	0	0	0	10	0	0	16.7	4.1
12	10	0	0	10	0	0	33.3	5.2
13	0	10	10	10	10	10	83.3	4.1
14	0	10	10	10	0	10	66.7	5.2
15	10	10	0	0	10	0	50.0	5.5
16	10	10	0	0	10	0	50.0	5.5
17	0	10	10	0	10	10	66.7	5.2
18	0	0	0	10	0	10	33.3	5.2
19	0	10	10	10	10	0	66.7	5.2
20	10	10	0	0	0	0	33.3	5.2
21	0	10	10	10	10	10	83.3	4.1
22	0	10	0	10	10	10	66.7	5.2
23	0	10	10	10	10	0	66.7	5.2
24	0	10	0	10	10	10	66.7	5.2
25	0	0	0	10	10	10	50.0	5.5
26	0	0	0	10	0	0	16.7	4.1
27	0	0	0	10	10	0	33.3	5.2
28	10	0	10	0	0	10	50.0	5.5
29	0	0	0	10	10	0	33.3	5.2
30	0	0	0	10	10	10	50.0	5.5
31	0	0	0	10	10	0	33.3	5.2
32	10	10	10	0	0	0	50.0	5.5
33	0	10	0	10	10	0	50.0	5.5
34	0	10	0	10	10	0	50.0	5.5
35	0	10	10	10	10	10	83.3	4.1
36	10	10	0	0	0	0	33.3	5.2
37	10	0	0	0	0	10	33.3	5.2

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
38	10	10	0	0	10	0	50.0	5.5
39	10	10	0	10	10	10	83.3	4.1
40	0	0	0	0	10	10	33.3	5.2
41	10	0	0	0	10	0	33.3	5.2
42	10	0	0	0	0	10	33.3	5.2
43	10	10	10	0	10	10	83.3	4.1
44	10	0	0	10	10	0	50.0	5.5
45	10	10	10	10	10	0	83.3	4.1
46	0	0	10	10	0	10	50.0	5.5
47	10	0	0	10	10	10	66.7	5.2
48	10	0	0	10	0	10	50.0	5.5
49	0	0	0	10	0	10	33.3	5.2
50	10	10	10	10	10	10	100.0	0.0
51	10	10	10	10	10	10	100.0	0.0
52	0	10	0	10	10	10	66.7	5.2
53	10	0	0	10	0	10	50.0	5.5
54	0	10	10	10	0	0	50.0	5.5
55	10	0	0	0	10	10	50.0	5.5
56	0	0	0	10	0	10	33.3	5.2
57	0	0	0	10	0	0	16.7	4.1
58	10	0	10	10	10	10	83.3	4.1
59	0	10	0	0	0	10	33.3	5.2
60	10	10	10	10	0	10	83.3	4.1
61	10	10	0	10	10	10	83.3	4.1
62	10	10	10	0	0	10	66.7	5.2
63	10	10	10	10	0	10	83.3	4.1
64	0	10	0	0	10	10	50.0	5.5
65	0	0	0	10	0	10	33.3	5.2
66	0	10	0	10	10	10	66.7	5.2
67	10	0	0	10	10	10	66.7	5.2
68	0	0	10	10	10	10	66.7	5.2
69	10	0	0	10	10	0	50.0	5.5
70	10	10	0	0	10	10	66.7	5.2
71	0	10	0	10	10	10	66.7	5.2
72	0	10	10	10	10	10	83.3	4.1
73	0	10	10	0	0	10	50.0	5.5
74	10	10	10	10	10	10	100.0	0.0
75	0	10	0	10	10	10	66.7	5.2
76	0	10	0	10	10	10	66.7	5.2
77	10	10	0	10	0	10	66.7	5.2
78	0	0	0	0	0	0	0.0	0.0
79	10	10	0	10	10	0	66.7	5.2

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
80	0	0	10	10	0	10	50.0	5.5
81	0	10	0	10	0	0	33.3	5.2
82	0	0	0	0	0	10	16.7	4.1
83	10	10	10	10	0	10	83.3	4.1
84	0	10	0	10	10	0	50.0	5.5
85	0	0	0	0	0	0	0.0	0.0
86	0	0	10	10	0	10	50.0	5.5
87	0	0	10	0	0	0	16.7	4.1
88	0	0	10	10	10	10	66.7	5.2
89	10	0	10	10	10	0	66.7	5.2
90	0	10	10	0	10	0	50.0	5.5
91	0	0	10	0	10	10	50.0	5.5
92	10	10	10	10	0	10	83.3	4.1
93	10	10	10	10	10	10	100.0	0.0
94	0	10	10	10	10	10	83.3	4.1
95	10	0	10	0	10	10	66.7	5.2
96	0	0	10	10	10	0	50.0	5.5
97	10	10	10	10	10	10	100.0	0.0
98	10	10	0	10	10	10	83.3	4.1
99	10	0	0	0	0	0	16.7	4.1
100	0	10	0	0	0	0	16.7	4.1
101	0	10	0	10	10	0	50.0	5.5
102	10	0	10	0	10	0	50.0	5.5
103	10	10	10	10	0	10	83.3	4.1
104	10	10	0	0	10	10	66.7	5.2
105	0	10	10	10	10	10	83.3	4.1
106	10	10	10	10	0	10	83.3	4.1
107	10	10	0	10	10	10	83.3	4.1
108	10	10	0	0	0	10	50.0	5.5
109	0	10	0	10	10	10	66.7	5.2
110	10	10	0	0	10	0	50.0	5.5
111	10	0	0	10	0	10	50.0	5.5
112	10	10	0	10	0	0	50.0	5.5
113	0	0	0	0	10	10	33.3	5.2
114	0	0	0	10	10	10	50.0	5.5
115	10	0	0	10	10	0	50.0	5.5
116	0	0	0	0	10	0	16.7	4.1
117	0	0	0	10	10	10	50.0	5.5
118	0	0	0	10	0	0	16.7	4.1
119	10	0	0	0	0	10	33.3	5.2
120	0	0	0	10	10	0	33.3	5.2
121	0	10	10	10	10	10	83.3	4.1

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
122	0	0	0	10	10	10	50.0	5.5
123	10	0	0	10	0	10	50.0	5.5
124	0	10	0	10	0	0	33.3	5.2
125	10	10	10	10	10	0	83.3	4.1
126	10	10	0	10	10	0	66.7	5.2
127	10	10	0	0	0	0	33.3	5.2
128	0	10	10	0	10	0	50.0	5.5
129	10	10	0	0	10	0	50.0	5.5
130	0	0	0	0	0	10	16.7	4.1
131	0	0	10	0	10	0	33.3	5.2
132	0	10	10	0	10	10	66.7	5.2
133	0	10	0	0	10	0	33.3	5.2
134	10	10	10	10	10	0	83.3	4.1
135	0	0	10	0	0	10	33.3	5.2
136	0	0	0	0	0	0	0.0	0.0
137	0	0	0	10	0	0	16.7	4.1
138	0	10	10	10	10	10	83.3	4.1
139	0	10	0	10	10	0	50.0	5.5
140	10	10	0	10	10	0	66.7	5.2
141	0	10	0	10	0	10	50.0	5.5
142	0	10	0	10	0	10	50.0	5.5
143	0	0	0	0	10	0	16.7	4.1
144	0	10	0	10	0	10	50.0	5.5
145	10	0	0	0	0	10	33.3	5.2
146	0	10	0	10	0	0	33.3	5.2
147	0	10	0	0	10	0	33.3	5.2
148	0	10	0	10	10	0	50.0	5.5
149	0	10	0	0	10	0	33.3	5.2
150	10	10	10	10	10	0	83.3	4.1
151	0	10	0	10	0	10	50.0	5.5
152	0	0	0	0	10	0	16.7	4.1
153	10	10	0	0	0	10	50.0	5.5
154	0	10	10	10	10	0	66.7	5.2
155	10	0	0	10	0	10	50.0	5.5
156	10	10	10	10	0	10	83.3	4.1
157	10	10	0	10	10	10	83.3	4.1
158	10	10	10	0	0	10	66.7	5.2
159	0	10	0	10	10	10	66.7	5.2
160	10	10	0	10	10	10	83.3	4.1
161	0	10	0	10	10	10	66.7	5.2
162	0	0	0	0	10	10	33.3	5.2
163	10	10	0	10	0	10	66.7	5.2

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
164	0	0	10	10	0	10	50.0	5.5
165	0	10	10	10	10	10	83.3	4.1
166	10	10	10	10	0	10	83.3	4.1
167	10	10	10	10	10	0	83.3	4.1
168	10	0	10	10	0	10	66.7	5.2
169	10	0	0	10	0	10	50.0	5.5
170	0	10	0	10	10	10	66.7	5.2
171	0	10	0	10	10	10	66.7	5.2
172	10	10	10	10	10	10	100.0	0.0
173	0	10	10	10	10	10	83.3	4.1
174	10	0	10	10	10	10	83.3	4.1
175	10	10	0	10	10	10	83.3	4.1
176	0	10	10	10	10	10	83.3	4.1
177	0	0	10	10	10	10	66.7	5.2
178	10	10	0	10	10	10	83.3	4.1
179	0	10	0	10	10	10	66.7	5.2
180	10	10	10	10	10	10	100.0	0.0
181	10	10	10	10	10	10	100.0	0.0
182	10	10	10	0	10	10	83.3	4.1
183	0	10	0	10	10	10	66.7	5.2
184	0	0	10	10	10	0	50.0	5.5
185	0	10	10	10	10	10	83.3	4.1
186	10	10	0	10	0	10	66.7	5.2
187	10	10	0	10	0	10	66.7	5.2
188	10	10	10	10	0	0	66.7	5.2
189	10	10	0	10	10	10	83.3	4.1
190	10	0	0	0	0	0	16.7	4.1
191	0	10	0	0	0	10	33.3	5.2
192	10	0	0	0	10	0	33.3	5.2
193	10	10	10	10	10	10	100.0	0.0
194	10	10	10	10	10	10	100.0	0.0
195	10	10	0	10	0	10	66.7	5.2
196	10	10	10	10	10	10	100.0	0.0
197	10	10	0	10	0	10	66.7	5.2
198	10	10	10	10	10	10	100.0	0.0
199	0	10	10	10	10	10	83.3	4.1
200	10	0	10	0	0	0	33.3	5.2
201	10	10	10	10	10	10	100.0	0.0
202	10	10	10	10	10	10	100.0	0.0
203	10	10	0	10	0	10	66.7	5.2
204	10	10	10	10	0	10	83.3	4.1
205	10	10	0	10	10	10	83.3	4.1

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
206	10	0	10	10	0	0	50.0	5.5
207	10	10	10	10	0	10	83.3	4.1
208	10	10	0	10	10	0	66.7	5.2
209	0	10	0	0	10	0	33.3	5.2
210	10	10	10	10	10	10	100.0	0.0
211	10	10	0	10	0	10	66.7	5.2
212	10	0	0	10	0	10	50.0	5.5
213	0	0	0	0	0	10	16.7	4.1
214	0	0	10	0	10	0	33.3	5.2
215	10	0	10	10	0	10	66.7	5.2
216	10	10	0	10	10	10	83.3	4.1
217	10	10	0	10	0	10	66.7	5.2
218	10	0	0	10	10	0	50.0	5.5
219	0	0	0	10	10	0	33.3	5.2
220	10	10	10	10	10	10	100.0	0.0
221	10	10	10	10	10	10	100.0	0.0
222	10	10	10	10	10	10	100.0	0.0
223	10	10	10	10	0	10	83.3	4.1
224	0	10	0	10	10	10	66.7	5.2
225	10	10	10	10	0	10	83.3	4.1
226	10	10	0	10	10	10	83.3	4.1
227	10	10	0	0	10	10	66.7	5.2
228	10	0	10	10	0	0	50.0	5.5
229	10	10	10	10	10	10	100.0	0.0
230	10	10	0	10	10	0	66.7	5.2
231	10	10	0	10	10	10	83.3	4.1
232	10	10	0	10	0	10	66.7	5.2
233	10	10	10	10	10	10	100.0	0.0
234	0	10	10	10	0	10	66.7	5.2
235	0	10	10	0	10	10	66.7	5.2
236	10	10	10	10	10	10	100.0	0.0
237	10	10	10	10	10	10	100.0	0.0
238	10	10	10	10	10	10	100.0	0.0
239	0	0	10	10	10	10	66.7	5.2
240	0	0	10	10	10	10	66.7	5.2
241	0	10	10	10	10	10	83.3	4.1
242	0	10	10	10	10	10	83.3	4.1
243	0	10	10	10	10	10	83.3	4.1
244	0	10	10	0	10	10	66.7	5.2
245	10	10	10	10	10	10	100.0	0.0
246	10	0	0	10	10	10	66.7	5.2
247	0	10	10	10	10	10	83.3	4.1

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
248	10	10	10	10	10	10	100.0	0.0
249	10	10	0	10	10	10	83.3	4.1
250	10	10	10	10	10	10	100.0	0.0
251	0	10	0	10	0	10	50.0	5.5
Means item	53.0	66.1	44.6	73.3	63.7	67.3	61.4	0.2
SD item	5.0	4.7	5.0	4.4	4.8	4.7		

Table 6.47. Data of 251 examinees grades in Group II (CR items), Physics Exam 1st Phase, 2004.

	Group II (CR items)														
Student	1.1(4)	1.2(11)	1.3(4)	1.4(15)	2.1(6)	2.2(14)	2.3(())	2.4(6)	3.1(10)	3.2(4)	3.3(6)	3.4(())	3.5(10)	Means st	SD st
1	3	11	4	5	6	14	11	4	6	0	0	1	0	65.0	4.6
2	4	11	4	14	3	0	0	0	9	0	6	0	0	53.0	4.9
3	2	11	0	12	5	9	0	4	0	0	0	0	0	43.0	4.6
4	3	2	4	5	3	14	0	0	5	4	0	0	0	40.0	3.8
5	3	11	4	12	5	1	1	5	8	1	0	0	0	51.0	4.2
6	2	11	4	2	5	13	12	2	6	3	0	3	2	65.0	4.3
7	0	11	0	15	6	14	0	2	9	0	0	0	10	67.0	5.9
8	0	11	0	15	4	14	8	4	6	3	6	2	8	81.0	4.9
9	0	6	4	0	5	11	9	4	8	3	5	0	0	55.0	3.7
10	2	7	0	14	5	14	0	6	6	0	0	0	6	60.0	5.0
11	0	2	2	15	5	2	1	2	7	0	3	0	7	46.0	4.2
12	0	0	0	6	5	1	4	2	0	0	0	0	0	18.0	2.2
13	2	2	0	12	5	6	12	3	6	1	0	6	0	56.0	4.2
14	0	5	0	14	2	14	5	2	6	1	0	0	2	51.0	4.9
15	0	10	4	14	6	14	0	0	9	4	0	0	0	61.0	5.4
16	4	11	4	15	4	1	3	2	10	2	0	0	0	56.0	4.8
17	4	2	0	2	5	2	3	0	6	4	3	0	6	37.0	2.1
18	2	2	0	15	4	14	0	0	10	2	6	0	10	65.0	5.5
19	4	8	2	8	5	14	1	4	0	4	0	0	0	50.0	4.2
20	0	2	0	0	5	1	3	0	0	0	0	0	0	11.0	1.6
21	4	8	2	9	5	2	9	3	8	0	0	0	0	50.0	3.6
22	0	11	4	15	4	1	6	0	10	4	6	0	0	61.0	4.8
23	2	7	5	5	2	0	1	0	0	0	0	0	0	22.0	2.4
24	0	0	0	8	5	8	0	3	6	0	6	2	6	44.0	3.2
25	4	8	4	9	6	14	0	0	8	4	6	4	4	71.0	3.8
26	2	3	0	11	6	14	0	0	3	6	1	0	0	46.0	4.6

Group II (CR items)															
Student	1.1(4)	1.2(11)	1.3(4)	1.4(15)	2.1(6)	2.2(14)	2.3(())	2.4(6)	3.1(10)	3.2(4)	3.3(6)	3.4(())	3.5(10)	Means st	SD st
27	2	3	0	5	5	14	0	3	10	4	6	0	6	58.0	4.1
28	4	11	4	13	6	2	3	2	8	4	6	6	6	75.0	3.3
29	2	11	2	15	6	14	0	0	7	1	6	0	0	64.0	5.5
30	2	2	4	3	4	6	8	0	8	4	6	8	10	65.0	2.9
31	2	11	4	12	3	1	0	3	0	2	3	0	2	43.0	3.9
32	4	5	4	0	4	10	0	2	8	4	6	0	6	53.0	3.1
33	4	10	0	15	5	9	3	1	8	4	6	8	0	73.0	4.4
34	4	11	0	14	4	14	6	3	9	4	6	8	8	91.0	4.2
35	0	0	4	15	5	14	0	1	8	0	3	0	0	50.0	5.4
36	4	3	0	15	4	14	0	0	7	2	6	4	4	63.0	4.8
37	4	11	1	13	5	12	10	0	9	1	1	0	0	67.0	5.1
38	4	2	0	0	5	3	2	1	0	0	0	0	0	17.0	1.8
39	4	11	0	0	6	0	4	1	9	2	0	0	0	37.0	3.8
40	0	0	0	5	5	0	0	6	6	0	0	0	0	22.0	2.7
41	1	5	2	15	5	0	1	2	8	0	0	0	0	39.0	4.4
42	2	2	0	7	5	14	0	2	10	4	6	6	0	58.0	4.2
43	2	0	0	0	5	14	10	3	10	4	6	0	10	64.0	4.8
44	4	10	2	0	5	6	0	0	8	4	4	0	2	45.0	3.2
45	2	9	2	12	6	6	0	6	4	4	6	6	5	68.0	3.1
46	4	9	4	15	4	1	0	4	0	6	0	0	8	55.0	4.5
47	2	10	2	12	5	14	10	0	6	0	6	0	8	75.0	4.8
48	0	2	4	4	5	10	6	0	7	0	3	0	4	45.0	3.1
49	0	9	0	15	6	8	8	3	10	0	6	6	6	77.0	4.4
50	4	9	2	12	6	14	3	0	10	0	6	0	5	71.0	4.6
51	4	10	2	12	6	14	10	3	0	0	6	0	6	73.0	4.7
52	0	6	0	12	6	10	10	3	8	0	6	0	0	61.0	4.5
53	0	9	0	14	6	14	2	0	4	4	6	0	5	64.0	4.9
54	4	5	4	12	6	14	12	6	7	4	6	0	10	90.0	4.0
55	2	7	0	7	4	2	3	0	10	0	6	0	0	41.0	3.4

Group II (CR items)															
Student	1.1(4)	1.2(11)	1.3(4)	1.4(15)	2.1(6)	2.2(14)	2.3(())	2.4(6)	3.1(10)	3.2(4)	3.3(6)	3.4(())	3.5(10)	Means st	SD st
56	2	9	0	2	6	14	11	5	0	0	0	0	0	49.0	4.9
57	4	0	4	2	6	14	0	3	7	1	0	2	0	43.0	4.0
58	2	11	4	15	5	14	11	6	10	4	6	8	10	106.0	4.0
59	0	5	2	15	6	14	12	0	10	4	6	0	2	76.0	5.3
60	0	11	4	15	6	4	12	1	10	0	6	0	10	79.0	5.1
61	4	10	4	12	6	1	6	6	4	4	6	6	4	73.0	2.8
62	0	11	4	15	5	14	12	0	10	4	2	6	8	91.0	5.1
63	0	7	0	15	5	14	12	0	10	4	6	4	10	87.0	5.2
64	2	11	4	12	6	14	6	0	7	4	6	0	0	72.0	4.6
65	0	5	0	12	5	1	12	6	7	0	6	0	1	55.0	4.4
66	0	10	0	12	5	3	3	0	7	0	6	6	0	52.0	4.1
67	2	11	0	14	0	14	8	3	4	4	6	7	6	79.0	4.7
68	4	11	2	0	5	14	12	0	10	2	6	0	3	69.0	4.9
69	4	11	4	12	3	14	0	3	4	2	1	0	8	66.0	4.7
70	4	10	4	13	4	0	11	2	4	4	0	7	0	63.0	4.3
71	4	0	4	15	6	12	3	0	10	2	6	8	10	80.0	4.6
72	4	9	0	12	5	12	10	0	9	0	6	4	4	75.0	4.3
73	4	3	4	12	6	14	9	2	10	4	6	4	10	88.0	3.8
74	4	5	4	15	6	14	0	6	10	4	6	0	10	84.0	4.6
75	4	10	4	15	5	14	9	2	10	0	6	6	4	89.0	4.5
76	2	11	2	15	5	14	9	3	9	2	6	0	10	88.0	4.9
77	2	2	4	0	5	10	10	0	0	1	4	4	5	47.0	3.4
78	2	9	0	0	6	0	11	2	0	0	0	0	0	30.0	3.8
79	2	11	4	15	6	14	0	5	8	4	5	8	8	90.0	4.4
80	0	11	4	14	6	14	7	0	8	4	5	5	2	80.0	4.6
81	4	11	2	15	6	14	0	3	9	4	5	0	0	73.0	5.2
82	0	0	2	15	6	8	5	0	8	4	3	0	4	55.0	4.3
83	4	11	4	15	6	14	0	0	10	4	6	8	0	82.0	5.1
84	4	9	0	8	6	10	4	2	0	0	0	0	0	43.0	3.8

						Group II (CR items)									
Student	1.1(4)	1.2(11)	1.3(4)	1.4(15)	2.1(6)	2.2(14)	2.3(())	2.4(6)	3.1(10)	3.2(4)	3.3(6)	3.4(())	3.5(10)	Means st	SD st
85	0	10	2	15	5	14	3	3	0	2	0	0	1	55.0	5.3
86	2	11	0	15	5	14	8	3	2	4	6	7	1	78.0	4.8
87	2	6	4	0	5	0	12	3	8	0	0	0	0	40.0	3.8
88	2	7	4	5	6	14	8	0	7	4	3	8	0	68.0	3.8
89	4	2	0	15	6	14	6	6	10	0	0	0	8	71.0	5.2
90	0	5	0	15	6	10	0	1	6	0	6	6	0	55.0	4.7
91	2	9	4	15	6	14	5	0	8	4	6	0	4	77.0	4.6
92	3	2	0	15	0	1	0	0	0	0	0	0	0	21.0	4.1
93	0	7	4	15	5	2	0	3	7	4	6	1	8	62.0	4.1
94	4	0	2	13	3	14	6	0	10	4	3	0	0	59.0	4.9
95	4	10	1	15	4	14	6	6	7	2	6	0	10	85.0	4.6
96	0	2	2	14	4	14	10	3	0	0	0	0	0	49.0	5.3
97	4	11	0	15	3	14	0	6	6	2	6	0	0	67.0	5.3
98	0	5	4	15	5	6	2	0	8	2	0	0	0	47.0	4.4
99	0	0	0	0	3	0	0	1	0	0	0	0	0	4.0	0.9
100	0	9	4	12	5	0	0	0	6	0	0	0	3	39.0	4.0
101	4	0	4	12	4	0	0	0	8	4	0	8	0	44.0	3.9
102	2	1	0	0	5	2	2	1	10	4	0	0	0	27.0	2.9
103	0	2	0	0	5	14	0	2	5	0	4	0	0	32.0	4.0
104	0	10	2	12	5	12	12	1	8	0	6	0	0	68.0	5.1
105	0	2	4	15	6	14	0	0	6	0	6	0	4	57.0	5.1
106	0	10	0	15	6	14	12	1	6	0	3	0	0	67.0	5.8
107	4	11	0	12	5	10	2	5	10	2	4	0	0	65.0	4.4
108	2	8	4	12	5	13	3	2	8	4	6	0	0	67.0	4.1
109	4	8	4	9	3	10	1	6	0	2	2	0	0	49.0	3.5
110	0	2	0	12	6	14	12	6	10	0	6	0	8	76.0	5.1
111	2	11	2	12	6	2	0	6	10	0	0	2	0	53.0	4.4
112	4	7	0	3	6	14	0	0	0	0	0	0	0	34.0	4.3
113	0	0	4	15	6	14	0	3	10	2	0	0	0	54.0	5.5

Group II (CR items)															
Student	1.1(4)	1.2(11)	1.3(4)	1.4(15)	2.1(6)	2.2(14)	2.3(())	2.4(6)	3.1(10)	3.2(4)	3.3(6)	3.4(())	3.5(10)	Means st	SD st
114	4	11	4	12	5	14	4	0	8	0	0	0	0	62.0	5.0
115	0	0	0	12	6	14	0	0	10	4	4	0	4	54.0	5.0
116	0	0	0	12	5	14	12	6	10	0	0	0	10	69.0	5.6
117	2	9	4	12	6	14	0	0	10	4	6	0	0	67.0	4.9
118	4	5	4	0	6	14	5	0	0	0	0	0	0	38.0	4.1
119	0	11	4	12	6	14	0	0	8	0	0	0	0	55.0	5.4
120	4	3	0	12	4	2	0	0	0	0	6	6	2	39.0	3.5
121	4	8	4	0	4	14	10	3	9	4	6	0	4	70.0	4.0
122	2	7	0	12	4	14	0	1	7	2	0	0	0	49.0	4.8
123	4	11	0	0	5	4	0	0	9	2	6	4	8	53.0	3.7
124	4	11	0	4	2	0	10	6	7	0	0	0	0	44.0	4.0
125	4	4	0	15	6	14	0	0	0	0	0	0	0	43.0	5.4
126	2	10	2	15	4	14	8	9	0	2	2	3	0	71.0	5.2
127	4	5	4	10	4	2	2	6	0	2	0	0	0	39.0	2.9
128	2	0	0	0	3	0	0	3	8	0	0	0	0	16.0	2.4
129	0	0	2	0	0	0	0	0	0	0	0	0	0	2.0	0.6
130	2	2	2	5	1	0	1	0	0	0	0	0	0	13.0	1.5
131	2	0	0	2	0	0	0	0	0	0	0	0	0	4.0	0.8
132	0	3	0	0	4	0	8	3	10	2	0	0	0	30.0	3.3
133	0	0	0	1	0	0	0	0	0	0	0	0	0	1.0	0.3
134	2	10	2	15	6	14	0	0	9	4	6	0	0	68.0	5.3
135	2	11	0	15	6	14	0	0	9	4	0	0	0	61.0	5.7
136	4	1	0	0	0	0	0	0	0	0	0	0	0	5.0	1.1
137	4	0	0	7	4	0	0	2	9	4	6	0	0	36.0	3.1
138	2	11	4	15	6	14	0	3	8	4	6	8	10	91.0	4.6
139	0	9	1	0	6	14	0	0	7	4	5	0	1	47.0	4.4
140	0	8	3	0	6	12	3	0	5	2	0	6	0	45.0	3.8
141	2	7	0	0	3	1	2	0	8	4	1	0	4	32.0	2.7
142	0	0	7	6	13	3	3	0	5	0	0	2	0	39.0	3.9
143	2	11	0	12	4	12	0	0	1	0	0	0	0	42.0	5.0

Group II (CR items)															
Student	1.1(4)	1.2(11)	1.3(4)	1.4(15)	2.1(6)	2.2(14)	2.3(())	2.4(6)	3.1(10)	3.2(4)	3.3(6)	3.4(())	3.5(10)	Means st	SD st
144	2	11	4	15	4	14	1	0	8	4	6	7	10	86.0	4.8
145	4	4	0	15	3	14	2	2	9	0	3	0	9	65.0	5.1
146	2	0	2	0	5	14	0	0	0	0	0	0	0	23.0	4.0
147	2	10	2	12	6	14	0	1	0	2	0	0	0	49.0	5.0
148	4	11	2	0	14	11	6	0	0	0	6	0	0	54.0	5.0
149	2	9	0	0	6	0	0	0	0	0	0	0	0	17.0	2.9
150	4	9	0	0	0	0	0	0	0	0	0	0	0	13.0	2.6
151	2	3	4	15	6	12	8	0	10	0	3	0	1	64.0	4.9
152	0	4	0	0	6	12	0	0	8	2	6	0	0	38.0	4.0
153	2	7	4	15	6	14	11	3	9	2	6	0	2	81.0	4.8
154	0	10	0	0	6	0	0	4	9	0	0	0	0	29.0	3.7
155	4	9	0	0	5	8	1	1	10	2	6	8	0	54.0	3.7
156	3	11	3	12	6	14	12	6	10	4	6	8	10	105.0	3.7
157	4	11	4	15	6	14	12	4	8	4	6	8	10	106.0	3.9
158	4	11	4	15	6	14	12	5	10	4	6	4	10	105.0	4.1
159	4	11	4	15	5	14	12	3	8	2	6	6	4	94.0	4.4
160	4	11	4	15	6	14	12	1	8	2	6	8	0	91.0	4.9
161	0	11	4	11	6	6	0	3	10	2	0	0	8	61.0	4.3
162	0	10	0	0	5	2	0	0	10	4	6	0	0	37.0	3.8
163	4	11	4	15	3	6	11	4	8	4	6	8	10	94.0	3.7
164	1	11	4	7	3	1	12	0	8	4	6	6	6	69.0	3.7
165	4	11	4	15	5	14	10	3	10	4	6	8	10	104.0	4.0
166	4	11	4	14	4	14	12	3	10	4	6	3	0	89.0	4.7
167	2	11	2	15	6	14	3	4	10	2	6	0	0	75.0	5.2
168	4	10	4	15	5	14	5	0	10	0	0	0	10	77.0	5.4
169	4	10	4	15	5	6	0	2	7	4	6	0	0	63.0	4.3
170	2	8	4	11	6	10	8	0	6	2	6	0	5	68.0	3.5
171	4	9	4	12	5	8	10	0	6	4	6	8	6	82.0	3.1
172	2	10	4	15	6	14	12	6	10	4	6	8	10	107.0	4.0

Group II (CR items)															
Student	1.1(4)	1.2(11)	1.3(4)	1.4(15)	2.1(6)	2.2(14)	2.3(())	2.4(6)	3.1(10)	3.2(4)	3.3(6)	3.4(())	3.5(10)	Means st	SD st
173	2	11	4	12	6	14	3	6	9	4	6	0	10	87.0	4.2
174	2	11	4	15	6	6	11	6	10	4	6	0	4	85.0	4.2
175	2	11	4	15	6	14	12	0	10	4	6	2	10	96.0	4.9
176	4	11	4	15	3	14	11	3	9	4	6	8	10	102.0	4.2
177	4	11	0	4	6	14	11	6	10	4	6	8	0	84.0	4.2
178	4	5	4	9	5	14	12	0	10	4	0	0	0	67.0	4.8
179	2	11	4	14	5	14	8	0	8	4	6	0	8	84.0	4.6
180	4	11	2	12	4	14	12	2	6	4	6	0	8	85.0	4.5
181	4	9	4	15	5	14	6	0	10	4	6	8	10	95.0	4.3
182	4	11	4	12	6	14	4	2	10	4	6	8	8	93.0	3.7
183	4	7	2	15	5	14	3	3	10	2	6	2	0	73.0	4.7
184	4	8	4	14	6	14	0	0	8	0	6	2	8	74.0	4.8
185	4	2	4	14	5	14	8	0	10	0	6	0	9	76.0	4.9
186	4	11	4	15	6	14	0	1	9	4	6	8	10	92.0	4.6
187	2	8	4	12	6	14	9	3	10	4	6	4	10	92.0	3.7
188	2	10	4	15	6	14	12	6	10	4	6	2	1	92.0	4.7
189	4	11	4	15	6	14	3	6	9	4	0	6	8	90.0	4.4
190	0	0	0	15	4	12	3	0	7	4	6	0	0	51.0	5.0
191	4	7	4	15	6	14	12	3	10	0	3	0	8	86.0	5.0
192	4	7	4	15	6	14	2	3	10	4	6	8	10	93.0	4.1
193	4	11	4	15	6	14	10	6	10	2	5	0	8	95.0	4.5
194	4	11	4	15	6	14	10	6	10	4	6	8	10	108.0	3.7
195	0	8	4	15	6	14	8	0	10	2	0	0	0	67.0	5.5
196	4	11	4	15	6	14	12	0	10	4	6	8	10	104.0	4.5
197	4	11	4	15	6	14	12	6	10	2	6	0	0	90.0	5.1
198	4	11	4	15	6	14	0	0	10	4	3	0	8	79.0	5.2
199	4	11	4	15	6	10	10	6	10	2	6	0	8	92.0	4.1
200	2	11	4	15	6	14	8	6	8	3	0	0	0	77.0	5.1
201	4	10	4	15	4	14	6	2	8	2	0	0	0	69.0	5.1

Group II (CR items)															
Student	1.1(4)	1.2(11)	1.3(4)	1.4(15)	2.1(6)	2.2(14)	2.3(())	2.4(6)	3.1(10)	3.2(4)	3.3(6)	3.4(())	3.5(10)	Means st	SD st
202	0	11	4	15	6	14	3	6	9	2	6	3	8	87.0	4.6
203	4	11	4	15	5	14	12	3	8	4	2	4	10	96.0	4.5
204	4	11	4	12	6	14	12	6	10	4	6	8	10	107.0	3.5
205	3	11	4	12	3	5	2	0	10	2	0	0	9	61.0	4.3
206	0	2	4	11	5	9	4	0	5	0	0	0	0	40.0	3.7
207	2	11	4	12	6	14	0	0	8	2	6	0	0	65.0	5.0
208	2	2	0	0	5	14	2	1	0	2	0	0	0	28.0	3.8
209	2	2	4	4	5	2	2	2	8	4	0	0	0	35.0	2.3
210	4	10	4	15	6	14	7	4	10	2	0	0	8	84.0	4.8
211	4	10	4	0	5	0	2	0	10	4	0	8	10	57.0	4.0
212	2	11	3	15	5	14	3	0	10	0	5	0	10	78.0	5.4
213	0	2	2	15	5	0	5	0	6	0	6	0	0	41.0	4.3
214	0	1	0	15	4	14	5	3	8	0	6	0	2	58.0	5.1
215	2	11	3	15	6	12	0	3	9	0	6	7	10	84.0	4.8
216	2	11	1	15	4	14	0	2	8	4	10	0	0	71.0	5.5
217	3	10	4	15	5	0	5	0	9	4	6	7	0	68.0	4.3
218	2	11	2	15	6	14	3	3	10	0	0	0	0	66.0	5.5
219	0	10	2	15	5	0	3	3	10	0	0	0	0	48.0	5.0
220	4	9	4	15	6	14	11	3	8	4	6	2	8	94.0	4.1
221	4	11	4	15	6	14	12	6	10	4	6	8	10	110.0	3.8
222	2	11	4	15	6	14	12	3	10	4	6	0	8	95.0	4.8
223	2	9	0	12	6	14	12	3	9	2	6	5	10	90.0	4.4
224	4	11	4	12	6	10	3	6	10	4	6	8	8	92.0	3.0
225	4	11	0	15	6	14	8	0	10	4	6	0	8	86.0	5.0
226	2	11	4	15	5	14	8	0	10	0	6	0	10	85.0	5.3
227	4	11	4	15	5	14	9	0	10	4	6	8	6	96.0	4.3
228	4	10	4	12	5	14	8	6	10	4	6	0	10	93.0	3.9
229	4	10	4	15	6	14	8	6	9	4	6	8	10	104.0	3.6
230	4	11	4	12	6	14	3	3	10	2	6	0	9	84.0	4.3

Group II (CR items)															
Student	1.1(4)	1.2(11)	1.3(4)	1.4(15)	2.1(6)	2.2(14)	2.3(())	2.4(6)	3.1(10)	3.2(4)	3.3(6)	3.4(())	3.5(10)	Means st	SD st
231	4	8	4	15	6	14	8	0	10	4	6	3	10	92.0	4.3
232	2	9	4	15	4	14	12	0	10	4	6	6	10	96.0	4.7
233	4	11	4	15	4	14	10	6	10	4	6	8	8	104.0	3.8
234	4	11	4	15	6	14	1	0	10	4	6	0	5	80.0	5.0
235	4	11	4	15	4	14	5	0	9	0	6	0	10	82.0	5.1
236	4	11	4	15	5	14	0	0	10	4	6	0	4	77.0	5.1
237	4	11	4	15	5	14	5	2	10	2	6	8	10	96.0	4.3
238	4	11	4	15	6	14	1	1	9	2	6	8	10	91.0	4.7
239	4	10	4	15	5	14	12	0	10	2	6	0	10	92.0	5.1
240	0	11	2	12	6	14	12	6	10	4	6	8	10	101.0	4.2
241	4	11	4	15	5	12	12	1	10	4	6	8	10	102.0	4.2
242	4	11	4	15	6	13	12	4	10	4	6	8	10	107.0	3.9
243	3	10	0	15	5	14	9	0	8	0	6	0	8	78.0	5.3
244	4	11	4	15	6	14	12	10	1	4	6	8	10	105.0	4.3
245	4	11	2	12	6	14	11	3	10	4	6	8	8	99.0	3.8
246	4	11	4	15	6	14	0	1	10	4	6	4	10	89.0	4.7
247	2	11	2	12	6	14	9	3	8	0	5	8	9	89.0	4.3
248	4	9	4	12	6	12	1	3	10	4	6	8	10	89.0	3.6
249	4	10	4	13	6	14	6	0	9	4	6	6	6	88.0	3.9
250	4	11	4	12	6	14	12	6	10	4	6	8	10	107.0	3.5
251	0	10	4	12	4	0	9	6	6	2	6	8	0	67.0	4.0
Means item	2.4	7.8	2.5	10.9	5.1	10.2	5.2	2.1	7.2	2.2	3.8	2.3	4.1	66.0	3.1
SD item	1.6	3.9	1.8	5.4	1.5	5.4	4.7	2.3	3.4	1.8	2.8	3.3	4.2		

Table 6.48. Data of 251 examinees grades in Group III (lab CR items), Physics Exam 1st Phase, 2004.

	Group III (CR items)					
Student	1(4)	2(7)	3(7)	4(())	Means st	SD st
1	4	7	7	2	20.0	2.4
2	4	7	6	11	28.0	2.9
3	4	3	6	0	13.0	2.5
4	4	7	7	0	18.0	3.3
5	4	7	6	0	17.0	3.1
6	4	7	5	9	25.0	2.2
7	4	7	5	12	28.0	3.6
8	4	7	5	12	28.0	3.6
9	4	3	3	10	20.0	3.4
10	4	7	4	2	17.0	2.1
11	4	0	3	2	9.0	1.7
12	4	0	3	2	9.0	1.7
13	4	3	5	0	12.0	2.2
14	4	3	0	2	9.0	1.7
15	4	0	0	0	4.0	2.0
16	4	3	7	0	14.0	2.9
17	0	0	3	0	3.0	1.5
18	4	5	7	0	16.0	2.9
19	4	7	0	0	11.0	3.4
20	4	0	0	0	4.0	2.0
21	0	0	0	0	0.0	0.0
22	0	0	7	0	7.0	3.5
23	0	1	7	0	8.0	3.4
24	4	0	3	0	7.0	2.1
25	4	5	5	12	26.0	3.7
26	4	2	3	0	9.0	1.7
27	4	2	6	11	23.0	3.9
28	4	0	6	0	10.0	3.0
29	4	0	7	0	11.0	3.4
30	0	6	4	12	22.0	5.0
31	4	0	4	0	8.0	2.3
32	4	5	3	0	12.0	2.2
33	4	5	7	6	22.0	1.3
34	4	0	0	0	4.0	2.0
35	4	4	7	0	15.0	2.9
36	4	4	7	0	15.0	2.9
37	0	7	0	11	18.0	5.4
38	4	7	7	0	18.0	3.3
39	4	3	7	1	15.0	2.5
40	4	0	7	0	11.0	3.4
41	4	3	0	0	7.0	2.1
42	0	0	7	0	7.0	3.5
43	4	7	5	12	28.0	3.6
44	4	0	0	4	8.0	2.3
45	4	5	6	6	21.0	1.0

	Group III (CR items)					
Student	1(4)	2(7)	3(7)	4(())	Means st	SD st
46	4	3	2	12	21.0	4.6
47	4	7	7	7	25.0	1.5
48	0	0	1	2	3.0	1.0
49	4	0	0	4	8.0	2.3
50	4	5	7	11	27.0	3.1
51	4	5	6	7	22.0	1.3
52	4	5	2	4	15.0	1.3
53	4	0	7	10	21.0	4.3
54	4	0	5	7	16.0	2.9
55	0	3	5	6	14.0	2.6
56	4	4	6	6	20.0	1.2
57	0	0	7	0	7.0	3.5
58	4	4	7	6	21.0	1.5
59	0	4	7	8	19.0	3.6
60	4	4	6	12	26.0	3.8
61	4	5	3	0	12.0	2.2
62	4	4	6	12	26.0	3.8
63	4	7	6	12	29.0	3.4
64	0	0	0	0	0.0	0.0
65	4	0	6	11	21.0	4.6
66	4	0	6	0	10.0	3.0
67	4	0	2	0	6.0	1.9
68	4	0	2	0	6.0	1.9
69	0	5	7	12	24.0	5.0
70	4	7	4	12	27.0	3.8
71	4	7	7	12	30.0	3.3
72	4	3	7	1	15.0	2.5
73	4	7	5	12	28.0	3.6
74	4	7	7	0	18.0	3.3
75	4	7	6	0	17.0	3.1
76	4	7	5	11	27.0	3.1
77	4	7	7	10	28.0	2.4
78	4	0	0	0	4.0	2.0
79	4	5	0	11	20.0	4.5
80	4	7	2	6	19.0	2.2
81	4	7	6	0	17.0	3.1
82	4	2	5	0	11.0	2.2
83	4	0	4	0	8.0	2.3
84	4	6	0	12	22.0	5.0
85	4	4	5	10	23.0	2.9
86	4	3	5	0	12.0	2.2
87	4	0	7	9	20.0	3.9
88	0	3	5	0	8.0	2.4
89	4	7	7	0	18.0	3.3
90	0	2	7	12	21.0	5.4
91	0	3	7	0	10.0	3.3
92	0	4	0	5	9.0	2.6
93	4	4	3	12	23.0	4.2
94	0	6	0	0	6.0	3.0
95	4	7	7	3	21.0	2.1

	Group III (CR items)					
Student	1(4)	2(7)	3(7)	4(())	Means st	SD st
96	4	7	7	10	28.0	2.4
97	4	7	7	12	30.0	3.3
98	4	3	7	0	14.0	2.9
99	4	2	1	0	7.0	1.7
100	4	0	6	0	10.0	3.0
101	4	2	0	0	6.0	1.9
102	4	0	6	0	10.0	3.0
103	4	4	6	0	14.0	2.5
104	4	0	0	0	4.0	2.0
105	4	0	0	0	4.0	2.0
106	4	2	5	7	18.0	2.1
107	4	7	4	5	20.0	1.4
108	4	7	6	12	29.0	3.4
109	4	10	7	2	23.0	3.5
110	4	3	4	2	13.0	1.0
111	4	7	7	8	26.0	1.7
112	4	0	7	10	21.0	4.3
113	4	0	7	11	22.0	4.7
114	3	0	3	7	13.0	2.9
115	4	0	7	5	16.0	2.9
116	4	7	0	5	16.0	2.9
117	4	0	3	5	12.0	2.2
118	4	0	7	12	23.0	5.1
119	4	0	7	0	11.0	3.4
120	4	0	0	12	16.0	5.7
121	4	5	0	0	9.0	2.6
122	0	2	0	0	2.0	1.0
123	0	0	0	0	0.0	0.0
124	4	5	0	2	11.0	2.2
125	4	3	5	1	13.0	1.7
126	4	2	7	1	14.0	2.6
127	4	4	0	0	8.0	2.3
128	0	0	0	0	0.0	0.0
129	4	0	0	0	4.0	2.0
130	4	2	0	0	6.0	1.9
131	4	6	7	4	21.0	1.5
132	4	3	0	0	7.0	2.1
133	0	0	0	0	0.0	0.0
134	4	6	7	12	29.0	3.4
135	4	7	5	2	18.0	2.1
136	4	0	0	0	4.0	2.0
137	0	0	0	0	0.0	0.0
138	4	4	7	1	16.0	2.4
139	4	0	0	1	5.0	1.9
140	4	6	0	0	10.0	3.0
141	4	2	7	2	15.0	2.4
142	4	3	2	0	9.0	1.7
143	4	3	6	0	13.0	2.5
144	4	7	7	1	19.0	2.9
145	0	0	0	0	0.0	0.0

	Group III (CR items)					
Student	1(4)	2(7)	3(7)	4(())	Means st	SD st
146	4	3	0	2	9.0	1.7
147	4	3	7	2	16.0	2.2
148	4	7	5	1	17.0	2.5
149	4	5	3	2	14.0	1.3
150	4	3	3	2	12.0	0.8
151	0	7	7	0	14.0	4.0
152	4	7	0	0	11.0	3.4
153	4	5	0	0	9.0	2.6
154	4	3	7	2	16.0	2.2
155	4	3	5	0	12.0	2.2
156	4	7	12	7	30.0	3.3
157	4	3	5	10	22.0	3.1
158	4	7	3	12	26.0	4.0
159	4	7	3	12	26.0	4.0
160	0	3	3	12	18.0	5.2
161	4	5	7	0	16.0	2.9
162	4	0	7	0	11.0	3.4
163	4	7	4	0	15.0	2.9
164	4	1	6	0	11.0	2.8
165	4	7	4	6	21.0	1.5
166	0	0	0	0	0.0	0.0
167	4	0	6	0	10.0	3.0
168	4	0	0	0	4.0	2.0
169	4	3	5	10	22.0	3.1
170	4	5	7	12	28.0	3.6
171	4	7	3	10	24.0	3.2
172	4	4	7	4	19.0	1.5
173	4	0	4	6	14.0	2.5
174	4	7	0	12	23.0	5.1
175	4	7	7	12	30.0	3.3
176	4	7	7	6	24.0	1.4
177	4	3	6	3	16.0	1.4
178	4	4	4	3	15.0	0.5
179	4	7	6	9	26.0	2.1
180	4	0	7	0	11.0	3.4
181	4	7	7	12	30.0	3.3
182	4	7	4	7	22.0	1.7
183	4	6	6	12	28.0	3.5
184	4	0	7	2	13.0	3.0
185	0	0	0	0	0.0	0.0
186	4	7	7	12	30.0	3.3
187	4	3	6	11	24.0	3.6
188	4	3	7	10	24.0	3.2
189	4	7	7	0	18.0	3.3
190	4	7	7	0	18.0	3.3
191	4	0	7	0	11.0	3.4
192	4	7	2	0	13.0	3.0
193	0	3	5	0	8.0	2.4
194	4	0	7	12	23.0	5.1

			Group III (CR items)			
Student	1(4)	2(7)	3(7)	4(())	Means st	SD st
195	4	7	0	12	23.0	5.1
196	0	0	7	12	19.0	5.9
197	4	0	5	0	9.0	2.6
198	4	7	5	12	28.0	3.6
199	4	7	7	12	30.0	3.3
200	4	3	5	0	12.0	2.2
201	2	7	7	0	16.0	3.6
202	4	7	6	11	28.0	2.9
203	4	7	6	12	29.0	3.4
204	4	7	7	3	21.0	2.1
205	0	2	5	2	9.0	2.1
206	0	0	0	0	0.0	0.0
207	4	2	6	0	12.0	2.6
208	4	7	2	0	13.0	3.0
209	4	0	6	10	20.0	4.2
210	4	4	7	1	16.0	2.4
211	4	5	2	0	11.0	2.2
212	4	0	5	0	9.0	2.6
213	4	0	2	0	6.0	1.9
214	0	0	2	0	2.0	1.0
215	4	3	0	12	19.0	5.1
216	4	3	7	0	14.0	2.9
217	4	0	5	12	21.0	5.0
218	4	5	4	0	13.0	2.2
219	4	0	7	0	11.0	3.4
220	4	3	7	12	26.0	4.0
221	4	7	7	2	20.0	2.4
222	4	7	7	12	30.0	3.3
223	4	7	3	11	25.0	3.6
224	4	5	4	10	23.0	2.9
225	4	7	7	12	30.0	3.3
226	4	0	6	12	22.0	5.0
227	4	7	0	11	22.0	4.7
228	4	7	7	5	23.0	1.5
229	4	7	0	0	11.0	3.4
230	4	0	0	7	11.0	3.4
231	4	5	7	12	28.0	3.6
232	4	3	0	2	9.0	1.7
233	4	5	5	0	14.0	2.4
234	4	7	7	0	18.0	3.3
235	4	1	7	11	23.0	4.3
236	4	7	0	2	13.0	3.0
237	4	7	7	12	30.0	3.3
238	4	7	7	1	19.0	2.9
239	4	6	7	12	29.0	3.4
240	4	7	7	3	21.0	2.1
241	4	7	0	2	13.0	3.0
242	4	7	5	12	28.0	3.6
243	4	7	6	0	17.0	3.1
244	4	7	0	12	23.0	5.1

	Group III (CR items)					
Student	1(4)	2(7)	3(7)	4(())	Means st	SD st
245	4	7	6	0	17.0	3.1
246	4	7	7	10	28.0	2.4
247	4	3	7	12	26.0	4.0
248	4	6	5	2	17.0	1.7
249	0	3	7	12	22.0	5.2
250	4	7	7	12	30.0	3.3
251	4	7	7	12	30.0	3.3
Means item	3.4	3.7	4.4	4.6	16.3	0.6
SD item	1.4	2.8	2.8	5.0		

Physics Exam 1st Phase, 2005

Table 6.49. Data of 148 examinees grades in Group I (MC items), Physics Exam 1st Phase, 2005.

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
1	10	10	10	10	10	0	83.3	4.1
2	0	0	0	10	10	10	50.0	5.5
3	10	0	10	0	10	0	50.0	5.5
4	10	10	0	10	10	0	66.7	5.2
5	10	0	10	10	10	10	83.3	4.1
6	10	10	0	10	0	0	50.0	5.5
7	10	10	10	10	0	0	66.7	5.2
8	10	10	10	10	10	0	83.3	4.1
9	10	10	0	10	10	10	83.3	4.1
10	10	10	0	10	0	0	50.0	5.5
11	10	10	10	10	10	10	100.0	0.0
12	10	0	10	0	10	0	50.0	5.5
13	10	0	10	10	10	0	66.7	5.2
14	10	0	10	0	10	0	50.0	5.5
15	10	10	10	10	0	10	83.3	4.1
16	10	10	10	10	10	10	100.0	0.0
17	10	10	0	0	0	10	50.0	5.5
18	10	0	10	10	10	10	83.3	4.1
19	10	0	10	10	10	10	83.3	4.1
20	10	10	10	0	10	0	66.7	5.2
21	10	0	10	10	0	0	50.0	5.5
22	10	0	0	10	10	0	50.0	5.5
23	0	0	10	10	10	0	50.0	5.5
24	10	0	10	10	0	0	50.0	5.5
25	10	10	10	10	0	10	83.3	4.1
26	10	0	10	10	10	0	66.7	5.2
27	10	0	10	0	10	10	66.7	5.2
28	10	0	10	10	10	0	66.7	5.2
29	10	0	10	10	0	0	50.0	5.5
30	10	0	10	10	10	10	83.3	4.1
31	10	10	10	10	10	0	83.3	4.1
32	10	0	10	0	0	0	33.3	5.2
33	10	0	10	10	10	10	83.3	4.1
34	10	10	10	10	10	0	83.3	4.1
35	10	0	10	10	10	0	66.7	5.2
36	0	0	0	10	10	0	33.3	5.2

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
37	10	10	10	10	10	10	100.0	0.0
38	10	10	10	10	0	0	66.7	5.2
39	10	0	0	0	0	0	16.7	4.1
40	0	10	0	0	0	0	16.7	4.1
41	10	10	10	0	10	10	83.3	4.1
42	10	10	10	10	10	10	100.0	0.0
43	10	0	10	10	10	10	83.3	4.1
44	0	0	10	10	0	0	33.3	5.2
45	10	0	10	0	10	0	50.0	5.5
46	10	10	10	10	10	10	100.0	0.0
47	10	10	10	10	10	0	83.3	4.1
48	10	0	0	0	10	0	33.3	5.2
49	10	10	10	0	10	10	83.3	4.1
50	10	10	10	10	10	10	100.0	0.0
51	10	10	10	10	10	10	100.0	0.0
52	0	0	0	0	10	0	16.7	4.1
53	10	0	10	10	10	10	83.3	4.1
54	10	10	10	10	10	10	100.0	0.0
55	10	10	10	10	0	10	83.3	4.1
56	10	0	0	10	10	10	66.7	5.2
57	10	0	10	10	10	10	83.3	4.1
58	10	0	10	10	10	10	83.3	4.1
59	10	0	10	0	10	0	50.0	5.5
60	10	0	10	10	10	10	83.3	4.1
61	10	10	0	10	10	10	83.3	4.1
62	10	0	10	10	10	0	66.7	5.2
63	0	0	0	10	10	0	33.3	5.2
64	10	0	10	0	0	0	33.3	5.2
65	0	10	10	0	10	10	66.7	5.2
66	10	10	10	10	10	10	100.0	0.0
67	10	10	10	0	10	10	83.3	4.1
68	10	0	10	0	10	10	66.7	5.2
69	0	10	10	0	0	0	33.3	5.2
70	10	10	10	10	10	10	100.0	0.0
71	10	10	10	0	10	0	66.7	5.2
72	10	0	10	0	0	0	33.3	5.2
73	10	0	10	10	10	10	83.3	4.1
74	10	10	10	10	10	0	83.3	4.1
75	10	10	10	0	10	10	83.3	4.1
76	0	10	10	0	10	0	50.0	5.5
77	10	10	0	10	0	0	50.0	5.5
78	10	0	10	0	0	0	33.3	5.2

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
79	0	0	0	10	0	0	16.7	4.1
80	10	0	10	10	10	10	83.3	4.1
81	0	0	10	0	10	10	50.0	5.5
82	10	10	0	0	0	0	33.3	5.2
83	10	10	10	10	10	0	83.3	4.1
84	10	0	10	10	10	10	83.3	4.1
85	0	0	0	0	0	10	16.7	4.1
86	10	0	10	10	10	10	83.3	4.1
87	10	0	10	10	10	10	83.3	4.1
88	0	10	0	0	10	0	33.3	5.2
89	10	0	0	0	0	10	33.3	5.2
90	0	10	0	0	0	0	16.7	4.1
91	10	0	10	0	10	10	66.7	5.2
92	0	0	0	10	0	0	16.7	4.1
93	10	10	10	0	10	0	66.7	5.2
94	10	0	10	0	10	0	50.0	5.5
95	10	10	10	0	10	10	83.3	4.1
96	10	0	10	10	10	0	66.7	5.2
97	10	0	10	10	10	0	66.7	5.2
98	10	0	10	0	0	0	33.3	5.2
99	0	10	10	0	10	10	66.7	5.2
100	10	0	10	10	0	0	50.0	5.5
101	10	10	10	0	0	10	66.7	5.2
102	10	10	10	10	10	0	83.3	4.1
103	10	0	10	0	10	0	50.0	5.5
104	0	10	10	10	0	0	50.0	5.5
105	10	0	10	10	0	10	66.7	5.2
106	10	0	0	0	10	10	50.0	5.5
107	10	10	0	0	10	10	66.7	5.2
108	10	10	10	10	10	10	100.0	0.0
109	10	0	10	10	0	10	66.7	5.2
110	10	10	10	10	10	10	100.0	0.0
111	0	0	10	10	0	0	33.3	5.2
112	10	0	10	10	0	0	50.0	5.5
113	10	10	10	10	10	0	83.3	4.1
114	10	0	10	10	10	0	66.7	5.2
115	10	0	10	10	10	10	83.3	4.1
116	10	10	10	10	10	10	100.0	0.0
117	10	10	10	10	10	10	100.0	0.0
118	10	0	10	10	10	10	83.3	4.1
119	10	10	10	10	0	0	66.7	5.2
120	10	0	10	10	10	0	66.7	5.2

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
121	10	10	10	10	10	10	100.0	0.0
122	10	0	0	10	10	10	66.7	5.2
123	10	10	10	0	0	0	50.0	5.5
124	0	0	10	10	10	0	50.0	5.5
125	0	10	10	10	10	10	83.3	4.1
126	0	0	10	10	10	0	50.0	5.5
127	10	10	10	0	10	0	66.7	5.2
128	0	10	10	10	10	0	66.7	5.2
129	0	0	10	10	10	0	50.0	5.5
130	10	10	10	0	0	10	66.7	5.2
131	10	0	0	10	0	0	33.3	5.2
132	10	10	10	10	10	10	100.0	0.0
133	10	0	10	10	10	0	66.7	5.2
134	10	0	10	10	10	10	83.3	4.1
135	10	0	10	0	10	10	66.7	5.2
136	10	10	10	10	10	0	83.3	4.1
137	10	10	10	10	10	10	100.0	0.0
138	10	0	10	10	10	0	66.7	5.2
139	10	0	10	10	10	0	66.7	5.2
140	10	0	10	10	10	0	66.7	5.2
141	10	10	10	10	10	10	100.0	0.0
142	10	10	10	0	0	0	50.0	5.5
143	10	0	0	10	10	0	50.0	5.5
144	10	10	0	0	10	0	50.0	5.5
145	0	0	0	10	0	0	16.7	4.1
146	10	10	10	10	10	10	100.0	0.0
147	10	10	10	10	10	10	100.0	0.0
148	10	0	10	10	10	10	83.3	4.1
Means item	83.1	46.6	79.7	68.2	73.0	46.6	66.2	0.5
SD item	3.8	5.0	4.0	4.7	4.5	5.0		

Table 6.50. Data of 148 examinees grades in Group II (CR items), Physics Exam 1st Phase, 2005.

	Group II (CR items)												
Student	1.1(())	1.2(())	1.3(5)	1.4(10)	2.1(10)	2.2(9)	2.3.1(11)	2.3.2(5)	3.1(13)	3.2(11)	3.3(16)	Means st	SD st
1	12	8	0	10	2	6	11	0	12	11	16	88.0	5.3
2	12	0	5	1	0	9	3	1	13	6	2	52.0	4.7
3	12	8	3	10	2	9	11	1	13	11	12	92.0	4.3
4	10	8	0	1	1	0	0	1	0	2	2	25.0	3.4
5	6	8	2	10	4	9	11	3	13	11	16	93.0	4.4
6	11	6	3	7	4	9	6	0	12	8	4	70.0	3.6
7	6	8	5	10	10	9	11	0	13	9	16	97.0	4.2
8	8	8	5	10	3	9	11	4	13	11	14	96.0	3.6
9	12	7	0	0	5	6	2	0	0	11	4	47.0	4.4
10	10	6	0	0	6	9	0	0	0	0	0	31.0	4.1
11	12	7	0	10	5	8	3	1	11	10	4	71.0	4.1
12	12	8	4	5	5	0	1	0	13	11	13	72.0	5.1
13	10	8	1	0	3	3	0	0	13	0	0	38.0	4.7
14	12	6	2	0	3	0	0	0	0	0	4	27.0	3.8
15	12	8	4	4	6	9	3	0	13	7	12	78.0	4.2
16	10	8	2	10	10	9	10	0	10	9	16	94.0	4.3
17	12	8	4	6	3	9	0	0	10	11	2	65.0	4.4
18	12	8	4	10	6	9	11	3	10	11	16	100.0	3.7
19	12	7	0	10	3	9	11	0	10	11	16	89.0	5.1
20	8	0	3	0	7	9	0	0	5	0	0	32.0	3.7
21	12	8	3	10	1	9	11	0	13	0	12	79.0	5.2
22	10	8	5	1	5	9	9	1	13	10	14	85.0	4.3
23	9	8	0	2	0	0	11	0	13	9	4	56.0	5.0
24	12	8	0	10	3	9	11	1	13	11	6	84.0	4.5
25	8	7	5	0	4	9	3	1	13	10	16	76.0	4.9
26	10	8	2	10	6	9	11	0	13	6	16	91.0	4.6

Group II (CR items)													
Student	1.1(())	1.2(())	1.3(5)	1.4(10)	2.1(10)	2.2(9)	2.3.1(11)	2.3.2(5)	3.1(13)	3.2(11)	3.3(16)	Means st	SD st
27	8	8	5	0	10	0	0	5	10	0	15	61.0	5.1
28	12	6	5	4	7	9	11	3	10	11	14	92.0	3.6
29	9	8	5	0	10	8	11	5	0	4	0	60.0	4.1
30	12	6	5	2	9	9	11	0	10	11	10	85.0	4.0
31	12	8	2	10	8	9	0	3	10	0	15	77.0	5.0
32	11	6	0	2	7	9	3	0	0	3	0	41.0	4.0
33	12	8	5	10	9	9	11	4	10	11	14	103.0	2.9
34	11	8	5	10	10	9	11	0	10	0	14	88.0	4.5
35	12	8	2	2	10	9	6	2	13	0	4	68.0	4.5
36	10	8	2	4	0	3	3	0	0	0	0	30.0	3.5
37	12	8	5	5	9	9	11	5	13	9	16	102.0	3.6
38	12	8	3	5	6	0	3	0	6	9	15	67.0	4.7
39	12	0	0	0	3	0	0	0	4	0	13	32.0	4.9
40	10	8	1	0	3	8	6	3	13	9	15	76.0	4.8
41	12	8	5	5	10	9	11	4	13	9	15	101.0	3.5
42	10	8	5	5	9	9	0	0	13	9	5	73.0	4.1
43	12	8	5	5	9	9	11	2	13	11	14	99.0	3.7
44	10	8	0	0	8	6	0	0	13	0	0	45.0	5.0
45	11	7	0	1	2	9	0	0	0	0	0	30.0	4.2
46	12	8	4	10	10	7	11	3	13	11	14	103.0	3.5
47	12	8	4	10	4	8	11	0	12	7	2	78.0	4.1
48	12	8	1	2	9	0	11	0	0	0	2	45.0	4.8
49	11	8	5	10	4	9	11	2	11	9	5	85.0	3.2
50	8	8	0	10	2	0	0	0	12	7	16	63.0	5.7
51	7	7	0	0	0	0	0	0	12	0	0	26.0	4.2
52	12	3	0	0	0	8	0	0	13	10	0	46.0	5.4
53	12	8	3	0	2	8	11	0	13	9	10	76.0	4.8
54	10	8	0	10	4	9	3	0	13	11	6	74.0	4.5
55	12	8	4	10	10	9	3	0	13	11	16	96.0	4.7

Group II (CR items)													
Student	1.1(())	1.2(())	1.3(5)	1.4(10)	2.1(10)	2.2(9)	2.3.1(11)	2.3.2(5)	3.1(13)	3.2(11)	3.3(16)	Means st	SD st
56	4	0	5	1	4	0	4	0	13	11	3	45.0	4.3
57	12	8	4	3	8	9	3	5	13	11	16	92.0	4.3
58	12	8	5	10	9	9	11	2	13	11	16	106.0	3.8
59	12	8	3	10	10	9	11	0	13	0	15	91.0	5.1
60	12	8	5	10	10	9	3	5	13	11	16	102.0	3.8
61	6	7	2	10	8	9	0	0	13	11	0	66.0	4.8
62	12	8	5	0	9	9	5	4	13	11	16	92.0	4.6
63	10	0	2	2	4	0	2	0	13	0	0	33.0	4.4
64	12	8	4	10	10	0	11	2	13	9	15	94.0	4.7
65	11	1	1	1	10	9	11	3	0	0	0	47.0	4.8
66	11	8	2	10	8	9	9	0	0	11	14	82.0	4.7
67	11	8	0	4	5	8	6	0	11	10	0	63.0	4.3
68	5	7	4	10	10	9	11	2	11	11	0	80.0	4.0
69	11	8	0	0	3	9	11	3	13	9	6	73.0	4.5
70	12	8	2	10	2	9	0	0	11	10	16	80.0	5.4
71	12	8	0	6	4	9	11	0	11	11	11	83.0	4.5
72	12	2	0	10	3	9	9	0	13	0	16	74.0	5.9
73	10	8	1	10	10	3	0	0	0	0	0	42.0	4.6
74	10	0	4	2	6	8	0	0	13	10	14	67.0	5.3
75	10	0	0	1	6	9	6	0	13	7	8	60.0	4.6
76	9	8	2	2	0	0	0	0	0	0	14	35.0	4.9
77	10	8	2	0	7	0	0	0	10	2	0	39.0	4.3
78	7	4	4	10	4	2	0	0	12	0	4	47.0	4.0
79	6	6	1	0	0	0	0	0	0	0	0	13.0	2.4
80	10	5	5	0	3	0	0	0	13	10	4	50.0	4.7
81	10	8	2	10	0	0	0	0	13	11	0	54.0	5.4
82	12	7	4	0	6	2	0	0	0	0	0	31.0	4.0
83	9	8	3	10	3	9	0	0	13	1	14	70.0	5.1
84	12	8	2	0	10	9	11	5	13	11	16	97.0	4.8
85	6	0	0	10	7	0	11	0	0	1	0	35.0	4.4

						Group II (CR items)						
Student	1.1(())	1.2(())	1.3(5)	1.4(10)	2.1(10)	2.2(9)	2.3.1(11)	2.3.2(5)	3.1(13)	3.2(11)	3.3(16)	Means st	SD st
86	4	8	2	10	10	9	10	0	13	6	16	88.0	4.7
87	12	0	2	10	6	8	0	0	13	0	0	51.0	5.3
88	6	8	0	0	0	0	0	0	0	0	0	14.0	2.9
89	0	0	2	10	5	9	2	2	0	9	0	39.0	4.0
90	6	1	0	0	2	0	0	1	13	0	0	23.0	4.0
91	12	8	5	10	7	9	11	0	13	11	14	100.0	4.0
92	12	6	0	0	8	7	0	1	0	0	0	34.0	4.3
93	12	2	0	0	10	9	0	0	13	11	14	71.0	6.0
94	10	8	0	10	0	0	11	1	13	8	4	65.0	5.0
95	11	8	5	10	5	9	0	4	13	11	16	92.0	4.6
96	12	8	2	10	6	0	11	0	2	0	4	55.0	4.6
97	12	8	4	10	6	9	0	0	11	11	16	87.0	5.0
98	12	8	0	0	2	0	3	0	0	0	4	29.0	4.0
99	10	2	2	10	2	9	0	0	13	4	0	52.0	4.8
100	12	1	0	1	3	0	0	0	13	6	0	36.0	4.9
101	12	7	0	0	6	9	11	0	11	0	0	56.0	5.2
102	12	8	2	7	6	9	11	3	11	11	16	96.0	4.1
103	6	8	2	0	8	9	11	0	10	6	0	60.0	4.2
104	12	8	5	10	10	9	9	0	10	9	16	98.0	4.0
105	12	8	5	10	0	9	3	2	13	11	16	89.0	5.0
106	12	8	2	2	3	9	3	0	10	6	16	71.0	5.0
107	12	8	5	10	6	9	6	4	13	11	6	90.0	3.0
108	12	8	5	10	10	9	4	0	13	11	7	89.0	3.9
109	12	8	0	2	2	9	11	0	10	9	16	79.0	5.4
110	12	8	5	10	10	0	11	5	10	11	10	92.0	3.6
111	12	8	5	1	10	9	0	0	0	0	0	45.0	4.8
112	11	8	5	10	6	9	0	0	13	0	14	76.0	5.2
113	11	8	2	0	3	9	0	0	11	11	16	71.0	5.6
114	12	8	5	10	6	8	2	0	11	11	2	75.0	4.1
115	10	8	5	10	5	9	11	3	13	3	16	93.0	4.2

Group II (CR items)													
Student	1.1(())	1.2(())	1.3(5)	1.4(10)	2.1(10)	2.2(9)	2.3.1(11)	2.3.2(5)	3.1(13)	3.2(11)	3.3(16)	Means st	SD st
116	12	8	5	10	1	9	3	0	13	11	14	86.0	4.9
117	12	8	0	2	10	9	6	0	13	6	12	78.0	4.7
118	7	8	0	10	10	0	11	3	13	11	16	89.0	5.2
119	10	7	0	10	10	1	3	0	0	6	6	53.0	4.2
120	12	8	2	10	4	9	11	0	13	14	0	83.0	5.2
121	12	8	0	0	4	9	0	0	0	0	4	37.0	4.4
122	12	7	2	10	0	0	4	0	13	2	12	62.0	5.3
123	11	2	3	10	6	7	3	5	11	8	5	71.0	3.2
124	5	8	5	10	7	8	3	0	4	6	4	60.0	2.8
125	10	8	4	10	2	9	11	1	13	11	15	94.0	4.5
126	10	8	2	10	2	4	11	0	13	4	12	76.0	4.6
127	7	4	0	0	3	7	0	0	13	3	6	43.0	4.1
128	5	8	0	3	10	2	5	0	0	9	0	42.0	3.8
129	8	8	0	6	0	0	0	0	10	4	0	36.0	4.0
130	12	7	0	10	10	9	6	0	13	11	12	90.0	4.6
131	12	7	2	10	10	9	0	5	13	11	2	81.0	4.5
132	12	8	4	10	10	9	6	2	13	11	16	101.0	4.0
133	11	8	5	10	6	9	6	2	13	2	2	74.0	3.8
134	11	7	2	2	0	8	11	0	11	1	14	67.0	5.2
135	12	8	4	10	6	9	11	3	13	5	8	89.0	3.3
136	12	7	0	10	6	4	0	0	11	6	0	56.0	4.7
137	12	8	5	10	6	9	11	0	13	8	2	84.0	4.1
138	12	8	5	10	6	2	6	0	11	11	14	85.0	4.4
139	12	8	0	10	9	9	4	1	12	11	13	89.0	4.5
140	12	8	5	10	6	9	0	0	13	0	8	71.0	4.7
141	6	0	0	0	7	6	0	5	12	3	0	39.0	4.0
142	12	6	0	6	6	7	3	1	11	10	6	68.0	3.8
143	12	8	0	10	3	8	11	1	13	9	0	75.0	4.9
144	11	8	3	10	5	9	3	0	12	7	14	82.0	4.3
145	12	4	1	0	0	8	11	1	13	10	0	60.0	5.4

Group II (CR items)													
Student	1.1(())	1.2(())	1.3(5)	1.4(10)	2.1(10)	2.2(9)	2.3.1(11)	2.3.2(5)	3.1(13)	3.2(11)	3.3(16)	Means st	SD st
146	12	8	5	10	10	9	11	5	13	9	16	108.0	3.3
147	6	8	5	8	6	9	0	0	13	11	9	75.0	4.1
148	9	8	3	3	10	9	0	1	12	11	0	66.0	4.6
Means item	10.4	6.7	2.5	5.9	5.6	6.6	5.3	1.0	10.0	6.7	8.1	68.8	2.8
SD item	2.3	2.5	2.0	4.4	3.3	3.6	4.8	1.6	4.8	4.5	6.6		

Table 6.51. Data of 148 examinees grades in Group III (lab CR items), Physics Exam 1st Phase, 2005.

	Group III (CR items)							
Student	1(6)	2(4)	3(6)	4(4)	5(4)	6(6)	Means st	SD st
1	6	4	6	4	4	0	24.0	2.2
2	6	4	6	4	0	2	22.0	2.3
3	6	2	6	6	4	4	28.0	1.6
4	5	4	6	4	4	2	25.0	1.3
5	6	4	6	4	4	0	24.0	2.2
6	6	4	6	4	0	2	22.0	2.3
7	6	4	6	4	4	6	30.0	1.1
8	6	4	6	4	4	4	28.0	1.0
9	4	4	2	2	4	6	22.0	1.5
10	1	4	4	4	0	2	15.0	1.8
11	6	4	3	2	4	6	25.0	1.6
12	1	4	0	0	4	0	9.0	2.0
13	2	2	0	0	2	5	11.0	1.8
14	0	4	2	0	2	0	8.0	1.6
15	1	4	6	4	0	6	21.0	2.5
16	6	4	6	4	4	6	30.0	1.1
17	6	4	6	2	0	6	24.0	2.5
18	6	4	6	4	0	0	20.0	2.7
19	0	4	6	0	0	2	12.0	2.5
20	5	4	4	4	0	1	18.0	2.0
21	6	4	6	0	0	1	17.0	2.9
22	6	4	4	4	0	6	24.0	2.2
23	0	4	6	4	4	1	19.0	2.2
24	0	4	4	4	0	1	13.0	2.0
25	1	4	6	4	3	1	19.0	1.9
26	6	4	6	4	4	6	30.0	1.1
27	6	4	4	0	4	0	18.0	2.4
28	6	1	0	0	4	6	17.0	2.9
29	6	4	2	0	4	2	18.0	2.1
30	6	4	4	4	4	4	26.0	0.8
31	6	4	6	4	4	6	30.0	1.1
32	6	4	6	4	4	0	24.0	2.2
33	6	4	6	2	4	6	28.0	1.6
34	6	4	6	3	4	0	23.0	2.2
35	6	3	5	0	4	0	18.0	2.5
36	6	3	5	0	0	2	16.0	2.5
37	4	4	4	6	4	6	28.0	1.0
38	6	4	0	0	0	0	10.0	2.7
39	0	4	4	0	0	2	10.0	2.0
40	6	3	0	0	0	0	9.0	2.5
41	0	2	6	4	0	2	14.0	2.3
42	6	2	5	0	4	6	23.0	2.4
43	6	2	5	4	4	6	27.0	1.5
44	0	2	2	0	0	2	6.0	1.1
45	6	4	6	0	0	0	16.0	3.0
46	6	4	6	4	4	0	24.0	2.2

Group III (CR items)								
Student	1(6)	2(4)	3(6)	4(4)	5(4)	6(6)	Means st	SD st
47	2	4	6	4	0	4	20.0	2.1
48	2	4	2	0	4	0	12.0	1.8
49	6	4	6	4	4	6	30.0	1.1
50	6	0	6	0	0	2	14.0	2.9
51	6	4	6	2	0	2	20.0	2.4
52	1	0	0	0	0	0	1.0	0.4
53	6	0	6	0	0	0	12.0	3.1
54	6	4	4	0	0	3	17.0	2.4
55	0	4	6	0	0	6	16.0	3.0
56	6	4	5	0	4	6	25.0	2.2
57	6	4	5	0	4	6	25.0	2.2
58	6	4	6	2	2	2	22.0	2.0
59	6	4	6	4	4	0	24.0	2.2
60	0	4	6	4	4	6	24.0	2.2
61	6	4	5	4	4	6	29.0	1.0
62	6	0	0	0	0	0	6.0	2.4
63	1	4	6	0	4	2	17.0	2.2
64	6	4	5	4	4	0	23.0	2.0
65	0	4	4	3	4	3	18.0	1.5
66	5	4	6	0	4	4	23.0	2.0
67	1	4	4	4	4	2	19.0	1.3
68	6	4	0	4	0	6	20.0	2.7
69	6	2	0	0	0	0	8.0	2.4
70	6	3	6	0	0	0	15.0	2.9
71	5	3	6	4	4	6	28.0	1.2
72	6	4	6	4	0	2	22.0	2.3
73	0	3	5	0	2	5	15.0	2.3
74	6	4	2	0	4	4	20.0	2.1
75	5	4	6	4	0	6	25.0	2.2
76	0	3	6	0	4	0	13.0	2.6
77	6	4	4	4	4	4	26.0	0.8
78	0	3	5	0	0	0	8.0	2.2
79	0	4	2	0	0	2	8.0	1.6
80	0	4	6	4	4	3	21.0	2.0
81	0	4	6	4	0	0	14.0	2.7
82	0	4	2	0	4	6	16.0	2.4
83	6	3	6	3	4	0	22.0	2.3
84	6	4	6	4	2	6	28.0	1.6
85	0	4	6	4	0	6	20.0	2.7
86	6	4	4	4	3	2	23.0	1.3
87	6	4	6	2	0	0	18.0	2.8
88	6	4	4	2	3	2	21.0	1.5
89	4	4	6	3	0	4	21.0	2.0
90	0	4	4	2	0	4	14.0	2.0
91	6	4	6	4	0	6	26.0	2.3
92	1	4	6	4	0	6	21.0	2.5
93	2	4	2	0	4	6	18.0	2.1
94	6	4	6	4	0	2	22.0	2.3
95	6	3	5	4	2	0	20.0	2.2
96	0	3	5	0	0	2	10.0	2.1

Group III (CR items)								
Student	1(6)	2(4)	3(6)	4(4)	5(4)	6(6)	Means st	SD st
97	0	4	6	3	0	0	13.0	2.6
98	0	4	2	0	0	3	9.0	1.8
99	6	4	2	4	4	5	25.0	1.3
100	6	4	6	4	0	4	24.0	2.2
101	6	4	6	3	4	6	29.0	1.3
102	6	3	4	3	0	3	19.0	1.9
103	6	4	6	4	4	6	30.0	1.1
104	6	4	6	4	4	6	30.0	1.1
105	6	4	6	0	4	0	20.0	2.7
106	6	4	4	4	4	2	24.0	1.3
107	1	3	5	0	0	6	15.0	2.6
108	6	4	6	4	4	2	26.0	1.5
109	0	4	6	4	4	2	20.0	2.1
110	6	4	6	4	4	6	30.0	1.1
111	6	2	3	4	0	2	17.0	2.0
112	6	3	6	4	4	0	23.0	2.2
113	0	4	6	4	0	3	17.0	2.4
114	0	4	6	4	0	6	20.0	2.7
115	1	4	6	4	4	6	25.0	1.8
116	0	4	6	4	4	6	24.0	2.2
117	6	0	2	4	4	6	22.0	2.3
118	5	4	5	4	4	4	26.0	0.5
119	6	4	6	4	0	2	22.0	2.3
120	6	4	2	4	0	2	18.0	2.1
121	5	4	4	4	0	4	21.0	1.8
122	0	4	2	0	4	4	14.0	2.0
123	6	4	0	4	4	0	18.0	2.4
124	5	2	0	0	0	0	7.0	2.0
125	0	4	6	0	4	2	16.0	2.4
126	0	4	6	0	0	0	10.0	2.7
127	5	4	4	4	4	4	25.0	0.4
128	5	4	6	4	2	2	23.0	1.6
129	5	4	6	0	0	4	19.0	2.6
130	6	3	6	4	0	6	25.0	2.4
131	6	0	0	0	3	0	9.0	2.5
132	6	4	6	4	4	2	26.0	1.5
133	4	3	0	0	0	0	7.0	1.8
134	6	3	6	4	0	2	21.0	2.3
135	6	4	6	0	0	0	16.0	3.0
136	6	2	1	0	4	0	13.0	2.4
137	6	3	6	0	0	0	15.0	2.9
138	6	4	6	4	4	0	24.0	2.2
139	6	4	6	4	4	2	26.0	1.5
140	6	4	6	2	4	6	28.0	1.6
141	6	4	4	4	4	2	24.0	1.3
142	6	0	0	0	0	6	12.0	3.1
143	6	4	6	3	0	6	25.0	2.4
144	6	4	2	1	4	6	23.0	2.0
145	6	3	6	0	4	2	21.0	2.3
146	6	4	6	3	4	6	29.0	1.3

Group III (CR items)								
Student	1(6)	2(4)	3(6)	4(4)	5(4)	6(6)	Means st	SD st
147	6	4	5	3	0	2	20.0	2.2
148	6	4	6	4	4	2	26.0	1.5
Means item	4.3	3.5	4.6	2.4	2.1	2.9	19.8	1.0
SD item	2.5	1.0	2.0	1.9	1.9	2.4		

Chemistry Exam 1st Phase, 1st call, 2003

Table 6.52. Data of 153 examinees grades in Group I (MC items), Chemistry Exam 1st Phase, 1st call, 2003

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
1	0	0	10	0	0	0	16.7	4.1
2	10	0	10	10	0	0	50.0	5.5
3	0	0	10	0	10	0	33.3	5.2
4	10	0	0	0	0	10	33.3	5.2
5	10	0	10	0	10	0	50.0	5.5
6	10	0	0	0	0	10	33.3	5.2
7	10	0	10	0	10	0	50.0	5.5
8	0	0	10	0	0	0	16.7	4.1
9	10	10	10	0	10	10	83.3	4.1
10	0	0	10	0	0	0	16.7	4.1
11	10	0	10	0	10	10	66.7	5.2
12	10	0	10	10	10	10	83.3	4.1
13	0	0	10	0	10	0	33.3	5.2
14	0	0	10	0	10	0	33.3	5.2
15	10	0	10	10	10	0	66.7	5.2
16	10	0	0	0	10	10	50.0	5.5
17	10	0	10	10	10	0	66.7	5.2
18	0	10	10	10	10	0	66.7	5.2
19	0	0	0	0	10	10	33.3	5.2
20	10	0	0	10	0	0	33.3	5.2
21	10	0	10	0	10	10	66.7	5.2
22	10	0	0	0	0	10	33.3	5.2
23	10	0	0	10	10	0	50.0	5.5
24	10	0	10	0	10	10	66.7	5.2
25	10	0	10	10	0	0	50.0	5.5
26	0	0	10	0	0	0	16.7	4.1
27	10	10	0	0	10	10	66.7	5.2
28	10	0	10	0	10	0	50.0	5.5
29	10	0	10	0	10	10	66.7	5.2
30	10	0	0	0	10	10	50.0	5.5
31	10	0	10	0	10	10	66.7	5.2
32	10	0	10	10	10	10	83.3	4.1
33	10	0	10	0	10	0	50.0	5.5
34	10	0	10	0	10	0	50.0	5.5
35	10	0	10	10	10	10	83.3	4.1
36	10	0	0	0	0	10	33.3	5.2
37	10	0	10	0	0	10	50.0	5.5
38	0	0	10	0	0	10	33.3	5.2
39	0	0	10	0	0	10	33.3	5.2
40	10	0	0	0	10	10	50.0	5.5
41	10	10	10	0	0	10	66.7	5.2
42	10	0	10	0	10	10	66.7	5.2
43	0	0	10	10	0	10	50.0	5.5
44	10	10	10	0	10	0	66.7	5.2
45	10	0	10	0	10	0	50.0	5.5

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
46	0	0	10	10	10	0	50.0	5.5
47	0	10	10	0	0	0	33.3	5.2
48	10	10	10	0	0	10	66.7	5.2
49	10	0	10	10	10	0	66.7	5.2
50	10	0	10	0	10	0	50.0	5.5
51	10	10	0	10	0	10	66.7	5.2
52	10	0	10	0	10	10	66.7	5.2
53	10	0	10	0	0	10	50.0	5.5
54	10	0	10	10	10	10	83.3	4.1
55	10	10	10	0	10	10	83.3	4.1
56	10	10	10	10	10	10	100.0	0.0
57	10	10	10	0	0	0	50.0	5.5
58	10	10	10	10	10	10	100.0	0.0
59	10	10	10	10	10	10	100.0	0.0
60	10	0	0	0	10	10	50.0	5.5
61	10	0	0	0	10	10	50.0	5.5
62	10	10	10	10	10	0	83.3	4.1
63	10	0	10	10	0	10	66.7	5.2
64	10	10	10	0	0	0	50.0	5.5
65	10	10	10	0	10	0	66.7	5.2
66	10	10	10	10	0	10	83.3	4.1
67	10	0	0	0	0	0	16.7	4.1
68	10	0	10	0	10	0	50.0	5.5
69	10	0	10	0	0	0	33.3	5.2
70	10	0	10	10	10	10	83.3	4.1
71	10	0	10	0	10	0	50.0	5.5
72	10	0	10	0	10	10	66.7	5.2
73	10	0	10	0	0	0	33.3	5.2
74	10	0	10	0	0	0	33.3	5.2
75	10	0	10	0	10	10	66.7	5.2
76	10	10	10	10	10	0	83.3	4.1
77	0	0	10	0	0	10	33.3	5.2
78	10	0	10	0	0	0	33.3	5.2
79	10	0	10	10	10	10	83.3	4.1
80	10	0	10	10	0	10	66.7	5.2
81	10	0	10	0	10	0	50.0	5.5
82	10	0	10	10	10	10	83.3	4.1
83	10	10	10	10	10	0	83.3	4.1
84	10	10	10	10	10	10	100.0	0.0
85	0	0	0	10	10	0	33.3	5.2
86	10	10	10	0	10	10	83.3	4.1
87	10	0	10	0	10	0	50.0	5.5
88	10	0	10	0	10	10	66.7	5.2
89	10	0	10	10	0	0	50.0	5.5
90	10	0	10	10	0	10	66.7	5.2
91	10	0	10	0	0	0	33.3	5.2
92	0	10	10	10	0	0	50.0	5.5
93	0	0	10	0	0	0	16.7	4.1
94	10	10	10	10	0	10	83.3	4.1
95	0	0	10	0	10	0	33.3	5.2
96	10	0	10	10	0	10	66.7	5.2
97	0	0	10	0	10	10	50.0	5.5
98	10	0	0	0	10	0	33.3	5.2

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
99	10	0	10	0	10	10	66.7	5.2
100	10	10	10	0	0	0	50.0	5.5
101	10	0	10	0	0	0	33.3	5.2
102	10	0	10	0	0	10	50.0	5.5
103	10	0	10	0	0	10	50.0	5.5
104	10	0	10	10	0	10	66.7	5.2
105	10	10	10	10	10	0	83.3	4.1
106	10	10	10	0	10	0	66.7	5.2
107	0	10	10	0	10	0	50.0	5.5
108	10	10	10	10	10	10	100.0	0.0
109	10	10	10	0	10	0	66.7	5.2
110	10	10	10	0	10	10	83.3	4.1
111	10	0	10	0	10	0	50.0	5.5
112	10	0	10	0	0	0	33.3	5.2
113	10	10	10	10	10	0	83.3	4.1
114	10	0	10	0	10	10	66.7	5.2
115	10	0	0	0	10	0	33.3	5.2
116	10	0	10	0	10	10	66.7	5.2
117	10	0	10	0	0	0	33.3	5.2
118	10	0	10	0	10	10	66.7	5.2
119	10	0	10	10	10	10	83.3	4.1
120	10	0	10	10	10	10	83.3	4.1
121	10	0	0	0	10	0	33.3	5.2
122	10	0	10	0	10	10	66.7	5.2
123	10	0	0	0	0	10	33.3	5.2
124	10	0	10	0	10	10	66.7	5.2
125	0	0	10	10	0	0	33.3	5.2
126	10	0	10	10	10	10	83.3	4.1
127	10	0	0	0	10	10	50.0	5.5
128	10	10	10	10	10	10	100.0	0.0
129	10	10	10	10	10	10	100.0	0.0
130	10	0	0	0	0	10	33.3	5.2
131	10	10	10	0	10	10	83.3	4.1
132	10	10	0	10	10	10	83.3	4.1
133	10	0	10	0	10	0	50.0	5.5
134	0	0	10	10	10	10	66.7	5.2
135	0	0	10	0	10	0	33.3	5.2
136	10	0	10	10	10	10	83.3	4.1
137	10	0	0	0	0	0	16.7	4.1
138	10	0	0	0	10	0	33.3	5.2
139	10	0	10	10	10	10	83.3	4.1
140	10	10	10	0	10	10	83.3	4.1
141	10	10	10	10	10	10	100.0	0.0
142	10	0	0	0	0	10	33.3	5.2
143	10	10	10	0	10	10	83.3	4.1
144	0	0	10	0	0	0	16.7	4.1
145	10	0	10	0	10	0	50.0	5.5
146	10	10	10	0	0	0	50.0	5.5
147	10	0	0	0	10	10	50.0	5.5
148	10	0	10	0	0	0	33.3	5.2
149	10	0	10	0	10	10	66.7	5.2
150	10	10	10	0	10	0	66.7	5.2
151	10	0	10	0	0	10	50.0	5.5

Group I (MC items)								
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
152	0	10	10	0	0	0	33.3	5.2
153	10	0	10	10	10	0	66.7	5.2
Means item	83.0	26.8	82.4	32.7	64.1	53.6	57.1	0.5
SD item	3.8	4.4	3.8	4.7	4.8	5.0		

Table 6.53. Data of 153 examinees grades in Group II (CR items), Chemistry Exam 1st Phase, 1st call, 2003

	Group II (CR items)																	
Student	1.1(7)	1.2(7)	1.3.1(4)	1.3.2(4)	1.3.3(4)	2.1(6)	2.2(3)	2.3(6)	2.4(())	3.1(11)	3.2(5)	3.3.1(())	3.3.2(())	4.1(9)	4.2(10)	4.3(6)	Means st	SD st
1	7	7	4	4	4	0	0	1	12	11	4	0	0	8	2	2	66.0	3.9
2	0	0	0	0	0	6	3	0	0	11	5	0	0	8	10	6	49.0	4.0
3	0	0	4	4	4	6	0	1	1	0	5	4	3	0	6	0	38.0	2.3
4	0	3	0	4	0	5	0	0	0	3	4	0	0	9	6	3	37.0	2.8
5	0	0	4	0	0	0	0	0	2	11	5	0	0	7	9	0	38.0	3.7
6	5	0	0	4	0	6	0	0	9	0	5	0	0	9	0	3	41.0	3.3
7	5	5	4	4	4	0	0	6	5	11	5	7	0	9	10	0	75.0	3.5
8	7	2	4	4	4	0	3	1	0	11	5	0	0	8	0	3	52.0	3.3
9	7	7	4	4	4	0	3	6	1	11	5	8	4	9	10	3	86.0	3.1
10	0	0	0	0	4	5	0	0	0	7	0	0	0	9	0	0	25.0	3.0
11	3	7	4	4	4	0	3	1	0	11	5	8	0	9	8	6	73.0	3.4
12	7	7	4	4	4	5	0	0	2	11	5	8	0	9	10	0	76.0	3.7
13	3	0	4	4	4	0	0	1	0	11	4	0	0	7	8	0	46.0	3.4
14	7	7	4	4	4	6	3	1	3	11	4	0	0	4	0	6	64.0	3.0
15	7	7	4	4	4	5	0	3	1	11	3	8	4	9	10	6	86.0	3.1
16	7	7	4	4	4	0	3	3	12	11	5	8	0	9	10	3	90.0	3.7
17	7	6	4	4	0	6	0	3	11	11	5	8	8	9	8	0	90.0	3.6
18	3	0	4	0	0	5	0	0	8	7	5	0	0	9	0	0	41.0	3.3
19	3	0	0	0	0	0	0	0	0	11	5	0	0	9	6	3	37.0	3.6
20	3	0	4	4	4	6	3	0	0	11	5	0	1	7	4	4	56.0	3.0
21	3	0	4	4	4	6	0	0	0	11	2	3	4	0	0	6	47.0	3.1
22	3	2	0	0	4	5	0	0	2	11	5	3	2	7	4	4	52.0	2.9
23	7	6	0	0	4	6	3	6	0	9	0	8	0	9	8	4	70.0	3.5
24	0	0	4	0	4	6	3	0	12	11	5	8	5	9	10	0	77.0	4.2
25	7	0	4	4	4	5	3	5	0	11	5	8	0	9	4	6	75.0	3.1

Group II (CR items)																		
Student	1.1(7)	1.2(7)	1.3.1(4)	1.3.2(4)	1.3.3(4)	2.1(6)	2.2(3)	2.3(6)	2.4(())	3.1(11)	3.2(5)	3.3.1(())	3.3.2(())	4.1(9)	4.2(10)	4.3(6)	Means st	SD st
26	3	0	0	4	0	0	0	0	0	0	4	0	0	7	0	6	24.0	2.4
27	5	7	4	4	4	0	3	1	2	11	5	8	8	9	8	6	85.0	3.0
28	4	3	4	4	4	0	3	6	2	11	5	3	0	9	10	6	74.0	3.2
29	5	0	4	4	4	0	3	6	0	11	5	8	7	9	10	6	82.0	3.4
30	3	0	4	4	0	6	0	0	12	6	5	6	0	2	8	3	59.0	3.4
31	0	0	4	4	4	0	3	6	6	11	5	8	4	9	10	6	80.0	3.4
32	5	7	4	4	4	5	0	0	0	11	5	8	0	0	8	0	61.0	3.5
33	2	0	4	4	4	0	3	5	0	10	5	8	0	9	10	0	64.0	3.7
34	2	0	4	4	4	5	0	1	0	7	5	3	4	7	6	6	58.0	2.4
35	5	0	4	4	4	5	3	0	0	11	5	8	0	7	4	6	66.0	3.1
36	3	0	4	4	4	0	0	0	0	10	5	7	0	6	0	0	43.0	3.2
37	3	0	4	4	4	6	0	0	0	0	5	8	0	6	0	3	43.0	2.7
38	5	0	4	4	4	0	0	1	0	11	5	3	4	7	0	6	54.0	3.1
39	0	4	0	0	0	0	0	1	4	0	4	0	0	7	0	0	20.0	2.2
40	0	0	4	0	0	4	3	5	0	0	0	0	4	7	0	0	27.0	2.4
41	5	0	4	4	4	6	3	6	4	11	5	8	4	9	2	6	81.0	2.7
42	5	5	0	4	0	4	0	3	2	11	5	4	0	7	0	3	53.0	3.0
43	7	7	4	4	4	6	0	0	0	0	5	4	0	9	0	0	50.0	3.1
44	4	0	0	4	0	0	0	1	2	11	2	6	0	7	0	6	43.0	3.3
45	5	2	4	4	4	6	3	2	0	5	1	6	0	7	4	6	59.0	2.2
46	7	2	4	4	4	5	0	3	7	11	5	1	0	7	4	0	64.0	3.1
47	0	0	4	0	0	0	0	0	0	0	5	8	0	7	0	3	27.0	2.8
48	7	6	4	4	4	0	0	6	0	8	5	1	4	9	8	3	69.0	3.0
49	0	0	4	4	4	6	3	0	0	11	5	8	0	9	0	3	57.0	3.6
50	7	7	4	4	4	5	0	3	4	11	5	8	4	7	8	6	87.0	2.6
51	5	6	0	4	4	0	3	6	3	11	4	8	0	8	8	3	73.0	3.2
52	7	7	4	4	4	6	3	0	0	11	5	8	0	9	2	6	76.0	3.3
53	2	7	4	4	4	6	0	0	0	11	5	0	8	9	0	6	66.0	3.6
54	0	0	4	4	4	5	3	6	7	11	4	7	8	0	0	0	63.0	3.4
55	5	7	4	4	4	0	1	0	0	11	5	8	0	8	4	6	67.0	3.4

Group II (CR items)																	
Student	1.1(7)	1.2(7)	1.3.1(4)	1.3.2(4)	1.3.3(4)	2.1(6)	2.2(3)	2.3(6)	2.4(())	3.1(11)	3.2(5)	3.3.1(())	3.3.2(())	4.1(9)	4.2(10)	4.3(6)	Means st	SD st
56	7	7	4	4	4	6	3	6	12	11	5	8	8	9	10	6	110.0	2.7
57	5	5	4	4	4	5	3	3	0	11	5	8	8	9	8	3	85.0	2.8
58	7	7	4	4	4	6	3	4	10	11	5	8	8	9	10	6	106.0	2.5
59	7	7	4	4	4	6	3	5	12	11	5	8	8	9	10	6	109.0	2.7
60	7	0	4	4	4	0	0	1	0	11	5	8	0	8	4	0	56.0	3.6
61	7	7	4	4	4	6	3	3	5	11	5	8	8	9	4	6	94.0	2.3
62	5	0	0	0	0	6	0	0	0	11	5	0	0	9	4	0	40.0	3.7
63	7	7	4	4	4	6	3	6	2	11	5	8	4	9	10	6	96.0	2.6
64	3	3	4	4	4	0	0	1	3	11	5	8	0	9	2	0	57.0	3.3
65	7	6	4	4	4	0	3	0	0	11	5	8	0	9	0	6	67.0	3.5
66	7	7	4	4	4	6	3	6	12	11	5	5	8	9	10	3	104.0	2.8
67	7	7	4	4	4	5	0	0	7	0	0	0	0	9	0	0	47.0	3.3
68	7	6	4	4	4	4	3	0	4	11	5	8	0	7	6	2	75.0	2.8
69	3	3	4	4	4	0	0	0	0	11	5	0	0	9	2	6	51.0	3.4
70	7	7	4	4	4	5	3	6	7	11	5	8	8	9	10	3	101.0	2.5
71	3	5	4	4	4	5	3	4	0	11	5	0	8	9	2	3	70.0	2.9
72	7	7	4	4	0	0	3	6	12	11	5	8	0	0	10	6	83.0	4.0
73	7	7	4	0	4	0	3	6	12	11	5	8	8	9	10	3	97.0	3.6
74	3	3	4	4	4	4	3	0	0	11	5	7	0	7	0	6	61.0	3.0
75	5	5	4	4	4	0	0	0	0	0	0	0	0	7	0	0	29.0	2.5
76	7	7	4	4	4	5	0	6	12	11	5	8	8	9	8	3	101.0	3.1
77	7	7	4	0	4	5	3	6	12	11	5	8	8	9	8	6	103.0	3.0
78	7	7	4	4	4	6	0	3	12	11	0	8	4	9	0	6	85.0	3.7
79	7	7	4	4	4	6	3	5	12	11	5	8	8	9	10	6	109.0	2.7
80	7	6	4	4	4	0	3	3	0	11	5	8	8	9	4	3	79.0	3.1
81	3	0	4	4	4	6	0	0	0	8	4	0	0	9	10	0	52.0	3.5
82	3	0	4	4	4	6	0	3	0	11	5	8	8	9	10	6	81.0	3.5
83	7	7	4	4	4	6	3	6	0	11	5	8	8	9	10	6	98.0	2.8
84	7	7	4	4	4	6	3	2	12	11	5	8	8	9	10	6	106.0	2.9
85	3	0	4	4	4	6	3	0	0	11	5	8	8	9	8	0	73.0	3.5

Group II (CR items)																		
Student	1.1(7)	1.2(7)	1.3.1(4)	1.3.2(4)	1.3.3(4)	2.1(6)	2.2(3)	2.3(6)	2.4(())	3.1(11)	3.2(5)	3.3.1(())	3.3.2(())	4.1(9)	4.2(10)	4.3(6)	Means st	SD st
86	3	0	4	4	4	0	3	0	0	11	5	8	4	9	10	3	68.0	3.6
87	0	0	4	4	4	2	3	0	0	0	0	0	0	7	8	0	32.0	2.7
88	7	7	4	4	4	6	0	0	0	11	5	8	8	9	6	5	84.0	3.2
89	3	0	0	4	4	0	3	0	0	11	5	8	0	9	4	2	53.0	3.5
90	3	7	4	4	4	6	0	5	0	11	5	2	4	9	2	6	72.0	2.9
91	3	0	0	4	0	6	3	0	0	11	5	7	0	9	4	6	58.0	3.5
92	7	2	4	4	4	5	2	0	0	11	3	0	0	9	2	4	57.0	3.2
93	5	0	4	4	4	6	3	0	0	11	2	8	6	9	6	6	74.0	3.2
94	7	7	4	4	4	5	3	2	8	11	5	8	7	9	10	6	100.0	2.6
95	5	2	4	4	4	6	3	2	2	11	5	7	0	9	2	6	72.0	2.9
96	6	0	4	4	4	3	0	3	3	11	5	8	0	9	10	6	76.0	3.4
97	7	5	4	4	4	3	0	2	0	0	5	3	8	9	10	4	68.0	3.1
98	7	0	4	4	4	6	3	3	0	11	5	2	7	9	10	6	81.0	3.2
99	5	7	4	4	4	5	0	2	7	11	5	0	4	9	1	6	74.0	3.0
100	5	7	4	4	4	6	3	3	12	11	5	8	0	9	10	6	97.0	3.3
101	7	7	4	4	4	6	3	6	0	11	5	8	0	9	10	6	90.0	3.1
102	4	7	4	4	4	5	3	3	1	11	5	8	0	9	8	6	82.0	2.9
103	4	0	4	4	4	5	3	6	0	7	3	2	0	9	6	5	62.0	2.6
104	7	7	4	4	4	5	3	5	12	11	5	6	4	7	8	6	98.0	2.5
105	5	7	4	4	4	0	3	3	0	11	5	8	8	9	10	6	87.0	3.2
106	7	7	4	4	4	5	0	6	12	11	5	8	8	9	10	6	106.0	3.1
107	7	7	4	4	4	0	3	3	6	11	5	4	0	7	10	6	81.0	3.0
108	7	7	4	4	4	0	3	6	12	11	5	8	0	9	10	6	96.0	3.5
109	7	7	4	4	4	5	3	3	10	11	5	3	0	9	8	6	89.0	2.9
110	7	7	4	4	4	6	3	6	5	11	5	8	8	9	6	6	99.0	2.1
111	7	7	4	4	4	0	3	4	8	11	5	8	0	9	10	5	89.0	3.2
112	7	7	4	4	4	0	3	3	6	11	5	6	0	9	8	6	83.0	3.0
113	7	7	4	4	4	5	3	6	12	11	5	8	8	9	8	6	107.0	2.6
114	7	7	4	4	4	5	3	5	12	11	5	6	4	9	8	6	100.0	2.6
115	6	7	4	4	4	6	3	5	5	9	5	8	6	9	8	6	95.0	1.8

Group II (CR items)																		
Student	1.1(7)	1.2(7)	1.3.1(4)	1.3.2(4)	1.3.3(4)	2.1(6)	2.2(3)	2.3(6)	2.4(())	3.1(11)	3.2(5)	3.3.1(())	3.3.2(())	4.1(9)	4.2(10)	4.3(6)	Means st	SD st
116	7	6	4	4	4	6	3	6	12	11	5	8	8	9	10	6	109.0	2.7
117	3	2	4	4	4	6	1	0	0	10	5	6	0	9	8	0	62.0	3.3
118	7	7	4	4	4	6	3	6	0	11	5	6	0	5	10	6	84.0	2.9
119	7	7	4	4	4	5	3	5	2	11	5	8	8	9	8	6	96.0	2.4
120	7	7	4	4	4	5	3	6	12	11	5	8	8	9	10	6	109.0	2.7
121	7	7	4	4	4	5	0	3	0	11	5	8	8	9	0	6	81.0	3.3
122	7	7	4	4	4	6	3	6	4	11	5	8	4	9	10	3	95.0	2.5
123	7	7	4	4	4	0	3	1	0	11	5	1	0	9	10	0	66.0	3.8
124	7	7	4	4	4	5	3	6	2	11	5	7	4	7	10	6	92.0	2.4
125	7	1	4	4	4	5	0	3	12	10	5	7	0	2	6	6	76.0	3.3
126	7	7	4	0	4	6	0	0	12	11	0	8	4	7	6	0	76.0	4.0
127	0	0	0	0	0	5	3	6	12	11	5	8	1	9	6	3	69.0	4.1
128	7	7	4	4	4	5	3	6	3	11	5	8	8	9	10	6	100.0	2.5
129	1	0	4	4	4	6	0	4	4	8	5	7	8	9	8	3	75.0	2.8
130	7	1	4	4	4	5	0	1	0	11	5	8	0	9	6	6	71.0	3.4
131	7	6	4	4	4	0	3	5	3	11	5	8	8	9	10	6	93.0	2.9
132	3	0	4	4	4	5	3	6	0	11	5	7	1	0	6	6	65.0	3.0
133	7	7	4	4	4	6	0	0	3	11	5	0	0	9	10	0	70.0	3.8
134	3	0	4	4	4	5	3	6	0	11	5	8	8	9	6	6	82.0	3.0
135	6	6	4	4	4	5	3	0	2	11	5	8	8	9	10	6	91.0	3.0
136	5	4	4	4	4	0	3	1	2	11	5	8	0	7	8	6	72.0	3.0
137	0	3	4	4	4	0	3	1	0	11	4	0	4	7	8	3	56.0	3.1
138	5	5	4	4	4	0	0	0	2	11	5	7	8	7	10	6	78.0	3.3
139	7	7	4	4	4	0	3	6	10	11	5	8	8	9	10	6	102.0	3.0
140	7	7	4	4	4	5	3	6	12	11	5	8	8	9	10	6	109.0	2.7
141	7	7	4	4	4	0	3	6	10	11	5	8	8	9	6	3	95.0	2.9
142	0	4	4	4	4	0	0	0	8	11	5	0	0	9	0	6	55.0	3.7
143	7	6	0	4	4	0	3	6	1	11	5	4	0	9	4	6	70.0	3.2
144	7	0	0	4	4	0	0	0	3	3	5	7	8	9	10	6	66.0	3.5
145	7	6	4	4	4	0	3	3	4	11	5	4	0	9	6	6	76.0	2.8

Group II (CR items)																		
Student	1.1(7)	1.2(7)	1.3.1(4)	1.3.2(4)	1.3.3(4)	2.1(6)	2.2(3)	2.3(6)	2.4(())	3.1(11)	3.2(5)	3.3.1(())	3.3.2(())	4.1(9)	4.2(10)	4.3(6)	Means st	SD st
146	7	7	4	4	4	0	3	1	0	11	4	8	0	9	6	3	71.0	3.3
147	7	7	4	4	4	0	3	3	8	11	5	4	8	9	10	6	93.0	2.9
148	3	0	4	4	4	0	0	5	2	11	0	8	4	9	6	3	63.0	3.3
149	3	0	4	0	4	0	0	1	0	11	0	2	4	7	4	5	45.0	3.1
150	6	7	4	4	4	0	0	0	2	11	4	8	4	9	10	6	79.0	3.5
151	5	3	4	4	4	0	3	6	0	11	5	8	0	9	10	3	75.0	3.4
152	0	0	0	4	4	0	3	6	3	11	5	4	8	0	8	6	62.0	3.4
153	0	0	4	4	4	5	3	6	0	11	5	8	4	9	8	0	71.0	3.4
Means item	4.9	4.0	3.5	3.6	3.5	3.4	1.8	2.8	3.8	9.7	4.5	5.6	3.2	8.0	6.3	4.1	72.7	2.0
SD item	2.4	3.1	1.3	1.3	1.3	2.7	1.5	2.5	4.6	3.1	1.3	3.2	3.5	2.1	3.7	2.4		

Table 6.54. Data of 153 examinees grades in Group III (lab CR items), Chemistry Exam 1st Phase, 1st call, 2003.

Group III (CR items)					
Student	1(())	2(())	3(10)	Means st	SD st
1	5	0	6	11.0	3.2
2	4	0	2	6.0	2.0
3	9	8	10	27.0	1.0
4	0	0	4	4.0	2.3
5	3	0	6	9.0	3.0
6	3	0	4	7.0	2.1
7	5	0	8	13.0	4.0
8	12	8	6	26.0	3.1
9	5	3	10	18.0	3.6
10	1	0	6	7.0	3.2
11	9	8	10	27.0	1.0
12	10	8	10	28.0	1.2
13	6	8	10	24.0	2.0
14	0	0	6	6.0	3.5
15	11	0	10	21.0	6.1
16	5	8	4	17.0	2.1
17	12	8	10	30.0	2.0
18	9	8	6	23.0	1.5
19	12	8	10	30.0	2.0
20	12	8	6	26.0	3.1
21	8	0	10	18.0	5.3
22	2	1	2	5.0	0.6
23	10	8	10	28.0	1.2
24	10	8	8	26.0	1.2
25	4	2	0	6.0	2.0
26	3	0	4	7.0	2.1
27	12	2	6	20.0	5.0
28	3	2	6	11.0	2.1
29	6	7	10	23.0	2.1
30	0	0	8	8.0	4.6
31	4	8	4	16.0	2.3
32	3	0	6	9.0	3.0
33	4	0	2	6.0	2.0
34	0	2	6	8.0	3.1
35	0	2	2	4.0	1.2
36	0	0	8	8.0	4.6
37	0	0	2	2.0	1.2
38	0	0	6	6.0	3.5
39	2	0	8	10.0	4.2
40	0	0	6	6.0	3.5
41	12	8	0	20.0	6.1
42	12	8	10	30.0	2.0
43	0	0	8	8.0	4.6
44	0	0	6	6.0	3.5
45	8	0	2	10.0	4.2
46	10	8	4	22.0	3.1
47	0	0	0	0.0	0.0

Group III (CR items)					
Student	1(())	2(())	3(10)	Means st	SD st
48	0	0	2	2.0	1.2
49	0	0	6	6.0	3.5
50	9	0	10	19.0	5.5
51	3	0	6	9.0	3.0
52	10	0	2	12.0	5.3
53	10	5	4	19.0	3.2
54	9	0	4	13.0	4.5
55	12	8	6	26.0	3.1
56	12	8	10	30.0	2.0
57	5	0	8	13.0	4.0
58	11	8	10	29.0	1.5
59	12	8	6	26.0	3.1
60	6	0	6	12.0	3.5
61	12	8	6	26.0	3.1
62	5	0	4	9.0	2.6
63	3	0	10	13.0	5.1
64	0	0	8	8.0	4.6
65	3	0	6	9.0	3.0
66	12	6	10	28.0	3.1
67	0	0	10	10.0	5.8
68	11	8	10	29.0	1.5
69	3	0	6	9.0	3.0
70	11	8	10	29.0	1.5
71	11	0	10	21.0	6.1
72	11	3	10	24.0	4.4
73	12	8	10	30.0	2.0
74	9	0	10	19.0	5.5
75	9	8	6	23.0	1.5
76	12	8	10	30.0	2.0
77	11	8	10	29.0	1.5
78	12	0	10	22.0	6.4
79	12	6	10	28.0	3.1
80	10	6	4	20.0	3.1
81	0	0	6	6.0	3.5
82	8	0	8	16.0	4.6
83	12	8	10	30.0	2.0
84	11	8	10	29.0	1.5
85	11	8	10	29.0	1.5
86	3	0	8	11.0	4.0
87	3	0	10	13.0	5.1
88	11	0	10	21.0	6.1
89	11	8	10	29.0	1.5
90	10	8	10	28.0	1.2
91	0	0	8	8.0	4.6
92	0	2	6	8.0	3.1
93	10	0	2	12.0	5.3
94	12	8	8	28.0	2.3
95	5	0	8	13.0	4.0
96	12	8	4	24.0	4.0
97	6	6	10	22.0	2.3

Group III (CR items)					
Student	1(())	2(())	3(10)	Means st	SD st
98	6	0	8	14.0	4.2
99	3	0	8	11.0	4.0
100	12	0	10	22.0	6.4
101	12	6	10	28.0	3.1
102	11	8	10	29.0	1.5
103	5	0	0	5.0	2.9
104	12	8	8	28.0	2.3
105	9	0	4	13.0	4.5
106	12	8	10	30.0	2.0
107	6	2	8	16.0	3.1
108	12	8	10	30.0	2.0
109	10	8	8	26.0	1.2
110	12	8	10	30.0	2.0
111	12	8	10	30.0	2.0
112	12	0	10	22.0	6.4
113	12	8	10	30.0	2.0
114	9	8	8	25.0	0.6
115	12	8	10	30.0	2.0
116	12	8	10	30.0	2.0
117	9	0	6	15.0	4.6
118	12	8	6	26.0	3.1
119	12	8	10	30.0	2.0
120	12	6	8	26.0	3.1
121	12	5	10	27.0	3.6
122	6	6	8	20.0	1.2
123	11	0	8	19.0	5.7
124	5	6	8	19.0	1.5
125	5	0	4	9.0	2.6
126	12	0	10	22.0	6.4
127	4	0	10	14.0	5.0
128	12	8	8	28.0	2.3
129	12	8	10	30.0	2.0
130	5	0	4	9.0	2.6
131	12	8	0	20.0	6.1
132	6	0	6	12.0	3.5
133	0	0	6	6.0	3.5
134	10	8	10	28.0	1.2
135	3	0	4	7.0	2.1
136	8	7	0	15.0	4.4
137	11	5	6	22.0	3.2
138	12	8	10	30.0	2.0
139	11	8	10	29.0	1.5
140	12	8	10	30.0	2.0
141	12	8	10	30.0	2.0
142	12	8	10	30.0	2.0
143	9	0	8	17.0	4.9
144	5	0	6	11.0	3.2
145	11	0	8	19.0	5.7
146	11	7	8	26.0	2.1
147	12	8	10	30.0	2.0

Group III (CR items)					
Student	1(())	2(())	3(10)	Means st	SD st
148	10	0	6	16.0	5.0
149	7	0	6	13.0	3.8
150	10	3	4	17.0	3.8
151	9	8	6	23.0	1.5
152	11	8	6	25.0	2.5
153	10	0	4	14.0	5.0
Means item	7.7	3.8	7.2	18.7	2.1
SD item	4.3	3.8	2.9		

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Table 6.55. Data of 317 examinees grades in Group I (MC items), Chemistry Exam 1st Phase, 2004.

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
1	10	0	10	0	0	10	50.0	5.5
2	10	0	10	0	0	0	33.3	5.2
3	0	0	10	10	0	10	50.0	5.5
4	10	0	10	10	0	10	66.7	5.2
5	10	0	10	0	0	10	50.0	5.5
6	0	0	10	0	0	10	33.3	5.2
7	0	0	10	10	0	0	33.3	5.2
8	0	0	0	0	10	10	33.3	5.2
9	10	10	10	0	0	0	50.0	5.5
10	0	0	10	0	0	0	16.7	4.1
11	10	0	10	10	0	10	66.7	5.2
12	10	10	10	0	10	10	83.3	4.1
13	10	0	10	0	0	10	50.0	5.5
14	10	10	0	0	10	0	50.0	5.5
15	0	0	10	0	0	0	16.7	4.1
16	10	0	10	10	10	0	66.7	5.2
17	0	0	10	10	0	10	50.0	5.5
18	10	10	0	0	0	0	33.3	5.2
19	0	10	10	10	0	10	66.7	5.2
20	0	0	0	0	0	0	0.0	0.0
21	10	0	10	0	10	10	66.7	5.2
22	0	10	0	0	0	0	16.7	4.1
23	0	0	0	0	10	0	16.7	4.1
24	0	0	0	0	0	0	0.0	0.0
25	10	10	10	10	0	0	66.7	5.2
26	10	10	10	0	0	0	50.0	5.5
27	10	0	0	0	0	0	16.7	4.1
28	10	0	10	0	10	10	66.7	5.2
29	0	0	0	0	0	10	16.7	4.1
30	10	10	10	10	0	10	83.3	4.1
31	0	0	10	0	10	10	50.0	5.5
32	10	0	0	10	0	0	33.3	5.2
33	10	0	0	10	0	10	50.0	5.5
34	10	0	0	0	0	10	33.3	5.2
35	10	10	0	0	0	10	50.0	5.5
36	0	0	10	10	0	0	33.3	5.2
37	0	0	0	0	0	0	0.0	0.0

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
38	0	0	0	0	0	0	0.0	0.0
39	0	0	0	0	0	0	0.0	0.0
40	10	0	0	0	0	10	33.3	5.2
41	0	0	0	0	0	0	0.0	0.0
42	10	0	0	0	10	0	33.3	5.2
43	0	10	0	0	0	10	33.3	5.2
44	10	0	10	10	0	0	50.0	5.5
45	0	0	10	10	0	10	50.0	5.5
46	0	0	10	0	0	10	33.3	5.2
47	10	0	0	10	0	10	50.0	5.5
48	10	10	0	10	0	0	50.0	5.5
49	0	0	0	0	0	0	0.0	0.0
50	10	0	0	10	0	0	33.3	5.2
51	10	0	0	0	0	0	16.7	4.1
52	10	10	0	0	0	0	33.3	5.2
53	10	0	0	10	0	0	33.3	5.2
54	0	0	0	0	0	10	16.7	4.1
55	10	0	0	0	0	0	16.7	4.1
56	10	0	10	0	0	0	33.3	5.2
57	0	0	0	10	0	0	16.7	4.1
58	10	10	10	0	0	10	66.7	5.2
59	10	0	10	0	10	0	50.0	5.5
60	10	0	0	0	0	0	16.7	4.1
61	0	10	0	0	0	0	16.7	4.1
62	10	10	0	10	0	10	66.7	5.2
63	0	0	0	0	0	10	16.7	4.1
64	0	0	10	0	0	10	33.3	5.2
65	0	0	0	0	0	10	16.7	4.1
66	0	10	0	0	0	10	33.3	5.2
67	10	0	0	0	0	0	16.7	4.1
68	10	0	0	10	0	10	50.0	5.5
69	0	0	0	0	0	10	16.7	4.1
70	0	0	0	0	0	0	0.0	0.0
71	10	0	0	0	0	10	33.3	5.2
72	0	0	10	10	0	0	33.3	5.2
73	0	0	0	0	0	10	16.7	4.1
74	0	0	10	0	0	0	16.7	4.1
75	10	0	10	0	0	0	33.3	5.2
76	0	0	10	0	0	0	16.7	4.1
77	0	0	0	0	0	0	0.0	0.0
78	10	10	0	0	0	0	33.3	5.2
79	10	0	10	10	0	10	66.7	5.2

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
80	10	0	0	0	0	0	16.7	4.1
81	10	0	0	0	0	10	33.3	5.2
82	10	10	0	0	0	0	33.3	5.2
83	10	10	0	0	0	0	33.3	5.2
84	10	0	10	0	10	10	66.7	5.2
85	10	10	0	0	0	0	33.3	5.2
86	10	0	10	10	0	10	66.7	5.2
87	10	10	10	10	10	0	83.3	4.1
88	0	10	0	0	10	0	33.3	5.2
89	0	0	0	0	0	0	0.0	0.0
90	0	10	10	0	0	0	33.3	5.2
91	10	0	10	10	0	10	66.7	5.2
92	0	10	10	10	0	0	50.0	5.5
93	10	0	0	0	0	0	16.7	4.1
94	10	0	10	10	10	0	66.7	5.2
95	0	0	0	0	0	0	0.0	0.0
96	10	10	0	0	0	0	33.3	5.2
97	10	10	10	10	10	10	100.0	0.0
98	10	0	0	10	0	10	50.0	5.5
99	10	0	10	10	0	10	66.7	5.2
100	10	10	10	10	0	10	83.3	4.1
101	10	0	10	10	10	10	83.3	4.1
102	10	10	0	10	0	0	50.0	5.5
103	10	10	0	10	0	0	50.0	5.5
104	0	10	10	10	0	0	50.0	5.5
105	10	10	0	0	10	0	50.0	5.5
106	10	10	10	10	0	10	83.3	4.1
107	10	0	0	10	10	0	50.0	5.5
108	10	0	10	0	0	10	50.0	5.5
109	10	0	0	0	0	0	16.7	4.1
110	0	10	10	0	0	0	33.3	5.2
111	10	10	0	0	0	10	50.0	5.5
112	10	10	0	0	10	10	66.7	5.2
113	0	0	0	0	10	0	16.7	4.1
114	10	0	10	10	0	10	66.7	5.2
115	0	0	10	10	10	10	66.7	5.2
116	10	0	10	10	0	10	66.7	5.2
117	10	0	0	0	0	10	33.3	5.2
118	0	0	0	10	0	10	33.3	5.2
119	10	10	10	10	0	0	66.7	5.2
120	10	0	10	0	10	10	66.7	5.2
121	0	10	10	10	0	0	50.0	5.5

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
122	0	0	10	10	10	0	50.0	5.5
123	10	0	0	10	0	10	50.0	5.5
124	0	0	0	10	0	0	16.7	4.1
125	0	0	0	0	0	0	0.0	0.0
126	10	0	10	10	0	10	66.7	5.2
127	0	0	10	10	0	0	33.3	5.2
128	0	0	0	0	0	0	0.0	0.0
129	0	10	10	0	0	0	33.3	5.2
130	0	10	10	0	0	10	50.0	5.5
131	10	0	0	0	0	0	16.7	4.1
132	10	0	10	0	0	0	33.3	5.2
133	0	10	10	0	0	0	33.3	5.2
134	10	10	10	0	0	10	66.7	5.2
135	10	10	0	0	0	10	50.0	5.5
136	10	0	0	0	0	10	33.3	5.2
137	10	10	10	0	0	0	50.0	5.5
138	10	10	0	10	0	10	66.7	5.2
139	10	0	10	0	0	0	33.3	5.2
140	10	0	10	0	0	10	50.0	5.5
141	10	10	10	0	0	0	50.0	5.5
142	10	0	0	0	0	10	33.3	5.2
143	10	0	0	0	0	0	16.7	4.1
144	10	0	10	10	0	10	66.7	5.2
145	10	10	10	0	0	0	50.0	5.5
146	10	0	10	0	0	0	33.3	5.2
147	10	10	0	0	0	0	33.3	5.2
148	10	0	0	0	0	0	16.7	4.1
149	0	0	0	0	0	10	16.7	4.1
150	0	10	10	0	0	0	33.3	5.2
151	10	10	0	0	0	10	50.0	5.5
152	10	0	10	0	0	0	33.3	5.2
153	10	10	10	10	10	10	100.0	0.0
154	10	0	10	0	0	0	33.3	5.2
155	10	0	0	0	0	10	33.3	5.2
156	0	0	0	0	0	0	0.0	0.0
157	10	0	10	10	0	0	50.0	5.5
158	10	0	0	10	10	10	66.7	5.2
159	10	10	0	0	0	0	33.3	5.2
160	0	0	0	0	0	0	0.0	0.0
161	0	0	10	0	0	10	33.3	5.2
162	0	0	0	0	0	0	0.0	0.0
163	0	0	0	0	0	0	0.0	0.0

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
164	10	0	0	0	0	10	33.3	5.2
165	10	0	0	0	0	0	16.7	4.1
166	10	10	10	0	10	10	83.3	4.1
167	0	10	0	0	0	10	33.3	5.2
168	10	10	0	0	0	0	33.3	5.2
169	10	0	0	0	0	0	16.7	4.1
170	0	0	10	10	0	10	50.0	5.5
171	10	0	10	0	0	0	33.3	5.2
172	0	10	10	10	0	0	50.0	5.5
173	10	10	10	10	10	10	100.0	0.0
174	10	10	10	10	10	10	100.0	0.0
175	0	0	0	0	0	10	16.7	4.1
176	10	10	10	10	0	10	83.3	4.1
177	10	10	10	10	10	10	100.0	0.0
178	10	0	0	10	10	0	50.0	5.5
179	10	10	10	10	0	0	66.7	5.2
180	10	10	10	10	0	10	83.3	4.1
181	10	10	10	10	10	10	100.0	0.0
182	10	0	10	0	10	10	66.7	5.2
183	10	10	0	10	10	10	83.3	4.1
184	10	0	10	0	0	10	50.0	5.5
185	10	10	0	0	0	10	50.0	5.5
186	10	10	10	10	0	10	83.3	4.1
187	10	10	10	10	10	10	100.0	0.0
188	10	0	0	10	0	10	50.0	5.5
189	10	10	10	0	10	0	66.7	5.2
190	10	10	0	0	10	0	50.0	5.5
191	10	10	0	10	0	0	50.0	5.5
192	10	0	10	10	10	0	66.7	5.2
193	10	0	10	10	10	10	83.3	4.1
194	10	0	0	0	10	0	33.3	5.2
195	10	0	0	10	0	0	33.3	5.2
196	10	0	10	0	0	0	33.3	5.2
197	10	0	0	0	0	0	16.7	4.1
198	10	10	0	10	10	10	83.3	4.1
199	10	0	10	10	0	10	66.7	5.2
200	10	0	10	10	10	10	83.3	4.1
201	10	10	0	10	10	10	83.3	4.1
202	10	0	10	10	0	0	50.0	5.5
203	10	0	0	0	10	10	50.0	5.5
204	10	10	10	10	10	10	100.0	0.0
205	10	10	10	10	10	10	100.0	0.0

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
206	0	10	10	10	10	0	66.7	5.2
207	10	10	10	0	10	0	66.7	5.2
208	10	0	0	10	10	10	66.7	5.2
209	10	0	10	0	0	10	50.0	5.5
210	10	10	10	0	0	10	66.7	5.2
211	10	0	10	10	0	0	50.0	5.5
212	10	0	0	0	0	10	33.3	5.2
213	10	10	10	10	10	0	83.3	4.1
214	10	0	10	0	0	0	33.3	5.2
215	10	10	0	10	10	0	66.7	5.2
216	10	10	10	10	10	0	83.3	4.1
217	10	0	10	0	0	10	50.0	5.5
218	10	10	0	0	10	10	66.7	5.2
219	10	0	0	0	0	0	16.7	4.1
220	10	0	0	0	0	10	33.3	5.2
221	10	10	10	0	10	10	83.3	4.1
222	10	0	10	0	10	10	66.7	5.2
223	10	0	0	10	0	0	33.3	5.2
224	10	10	10	10	10	10	100.0	0.0
225	10	10	10	10	0	10	83.3	4.1
226	10	10	0	0	0	10	50.0	5.5
227	0	0	0	10	0	10	33.3	5.2
228	10	10	10	10	10	10	100.0	0.0
229	0	0	10	0	0	0	16.7	4.1
230	10	0	0	10	0	0	33.3	5.2
231	10	0	10	10	10	10	83.3	4.1
232	10	0	0	10	0	0	33.3	5.2
233	10	10	0	10	0	10	66.7	5.2
234	10	0	0	10	0	10	50.0	5.5
235	10	10	10	10	10	0	83.3	4.1
236	10	10	10	10	10	0	83.3	4.1
237	10	0	0	0	0	10	33.3	5.2
238	10	10	0	10	10	10	83.3	4.1
239	10	10	10	10	10	10	100.0	0.0
240	10	10	10	10	10	10	100.0	0.0
241	10	0	10	0	0	10	50.0	5.5
242	0	0	0	10	0	10	33.3	5.2
243	10	10	10	10	0	0	66.7	5.2
244	0	0	10	10	0	10	50.0	5.5
245	10	10	10	10	10	10	100.0	0.0
246	0	10	0	10	10	0	50.0	5.5
247	10	10	0	10	10	10	83.3	4.1

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
248	10	0	10	10	0	0	50.0	5.5
249	10	10	0	0	10	0	50.0	5.5
250	10	10	10	10	10	10	100.0	0.0
251	10	10	0	10	0	0	50.0	5.5
252	10	10	10	10	10	10	100.0	0.0
253	10	10	0	10	0	10	66.7	5.2
254	10	10	10	10	10	10	100.0	0.0
255	0	0	10	10	0	10	50.0	5.5
256	10	10	10	0	10	0	66.7	5.2
257	10	10	10	10	10	0	83.3	4.1
258	10	0	10	10	0	10	66.7	5.2
259	0	10	10	10	0	0	50.0	5.5
260	10	10	10	10	0	10	83.3	4.1
261	10	10	10	10	10	10	100.0	0.0
262	10	10	10	10	10	10	100.0	0.0
263	10	10	10	10	0	0	66.7	5.2
264	10	10	10	10	10	10	100.0	0.0
265	0	10	10	10	10	10	83.3	4.1
266	10	10	10	10	10	10	100.0	0.0
267	10	10	10	10	0	10	83.3	4.1
268	10	10	10	10	10	10	100.0	0.0
269	10	10	0	10	0	0	50.0	5.5
270	10	10	10	0	10	10	83.3	4.1
271	0	0	10	0	0	0	16.7	4.1
272	10	10	10	10	10	10	100.0	0.0
273	10	0	0	10	10	10	66.7	5.2
274	10	10	10	10	10	10	100.0	0.0
275	10	0	10	10	0	10	66.7	5.2
276	10	10	10	10	0	0	66.7	5.2
277	10	10	0	10	0	10	66.7	5.2
278	10	0	10	10	0	10	66.7	5.2
279	10	0	0	0	0	10	33.3	5.2
280	0	0	0	10	0	0	16.7	4.1
281	10	10	0	10	0	0	50.0	5.5
282	0	10	0	10	0	10	50.0	5.5
283	0	10	10	10	0	0	50.0	5.5
284	10	10	0	0	10	10	66.7	5.2
285	0	0	0	10	0	10	33.3	5.2
286	10	10	10	10	10	10	100.0	0.0
287	0	10	0	10	0	0	33.3	5.2
288	10	10	10	0	0	0	50.0	5.5
289	10	10	0	0	0	10	50.0	5.5

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
290	10	10	10	10	10	10	100.0	0.0
291	10	0	10	0	10	10	66.7	5.2
292	10	0	0	10	10	10	66.7	5.2
293	10	0	0	10	0	0	33.3	5.2
294	10	0	10	10	0	10	66.7	5.2
295	10	10	10	0	10	0	66.7	5.2
296	10	10	0	0	10	10	66.7	5.2
297	10	10	10	0	0	0	50.0	5.5
298	0	0	10	10	0	0	33.3	5.2
299	10	10	10	10	10	10	100.0	0.0
300	10	0	10	0	0	10	50.0	5.5
301	10	0	0	10	10	10	66.7	5.2
302	10	0	0	10	10	10	66.7	5.2
303	10	10	10	0	10	0	66.7	5.2
304	10	10	10	10	10	10	100.0	0.0
305	10	0	0	0	0	10	33.3	5.2
306	10	10	10	0	10	0	66.7	5.2
307	0	10	10	10	10	10	83.3	4.1
308	10	10	10	10	10	10	100.0	0.0
309	10	10	0	10	10	10	83.3	4.1
310	10	0	0	0	10	0	33.3	5.2
311	10	0	10	10	10	10	83.3	4.1
312	10	0	0	10	10	0	50.0	5.5
313	10	10	10	10	10	10	100.0	0.0
314	10	0	10	10	10	10	83.3	4.1
315	10	10	10	10	10	10	100.0	0.0
316	10	10	10	10	10	10	100.0	0.0
317	10	10	0	10	10	0	66.7	5.2
Means item	73.5	45.1	53.9	50.2	33.1	53.3	51.5	0.2
SD item	4.4	5.0	5.0	5.0	4.7	5.0		

Table 6.56. Data of 317 examinees grades in Group II (CR items), Chemistry Exam 1st Phase, 2004.

	Group II (CR items)															
Student	1.1(())	1.2(11)	2.1(10)	2.2(13)	2.3.1(6)	2.3.2(4)	2.4(4)	3.1(7)	3.2(6)	3.3.1(6)	3.3.2(5)	4.1(6)	4.2(15)	4.3(5)	Means st	SD st
1	9	7	10	4	6	4	4	1	0	6	5	6	8	0	70.0	3.1
2	12	3	10	7	4	0	1	0	6	5	6	4	0	0	58.0	3.8
3	12	11	10	13	6	2	4	7	6	6	5	6	4	2	94.0	3.5
4	7	7	10	7	5	4	4	0	0	6	0	6	2	5	63.0	3.1
5	12	7	10	5	4	4	4	0	6	5	0	6	4	5	72.0	3.2
6	10	9	3	4	4	6	0	0	0	5	6	0	0	0	47.0	3.5
7	1	0	10	3	4	0	0	0	3	0	6	6	5	0	38.0	3.1
8	12	3	10	7	1	0	0	1	0	3	6	0	0	5	48.0	4.0
9	1	3	10	7	6	4	0	7	6	0	6	0	0	0	50.0	3.4
10	12	9	10	10	0	0	6	0	3	6	2	0	0	0	58.0	4.6
11	9	3	4	10	10	0	0	0	4	0	2	6	5	6	59.0	3.7
12	12	3	10	10	4	4	0	0	0	6	5	0	0	0	54.0	4.3
13	10	3	7	3	0	2	2	0	0	2	0	5	6	2	42.0	3.0
14	5	7	10	7	6	0	4	6	0	6	0	4	0	0	55.0	3.4
15	12	8	10	7	1	2	4	6	0	0	0	0	0	0	50.0	4.3
16	12	0	10	7	4	2	3	0	4	6	0	0	0	0	48.0	4.0
17	12	0	10	0	7	0	6	5	6	0	13	6	2	0	67.0	4.6
18	12	0	10	0	5	0	4	0	0	0	0	6	0	0	37.0	4.1
19	4	0	0	7	2	2	4	0	0	6	0	6	0	5	36.0	2.7
20	0	0	0	0	0	4	0	2	0	0	0	0	0	0	6.0	1.2
21	12	10	0	2	2	2	4	0	0	6	5	6	0	0	49.0	3.9
22	0	10	6	0	0	0	4	0	0	3	5	0	0	0	28.0	3.2
23	0	0	0	12	1	0	0	0	0	6	0	6	0	0	25.0	3.6
24	12	3	11	2	0	0	4	7	6	3	5	2	0	0	55.0	3.9
25	5	0	10	0	4	0	4	0	3	0	5	6	0	0	37.0	3.2
26	3	3	6	0	0	0	4	0	4	6	5	0	0	0	31.0	2.5
27	8	4	6	2	0	0	4	0	0	3	5	6	2	0	40.0	2.7

Group II (CR items)																
Student	1.1(())	1.2(11)	2.1(10)	2.2(13)	2.3.1(6)	2.3.2(4)	2.4(4)	3.1(7)	3.2(6)	3.3.1(6)	3.3.2(5)	4.1(6)	4.2(15)	4.3(5)	Means st	SD st
28	10	11	6	6	0	0	0	6	0	0	5	6	2	0	52.0	3.9
29	6	0	10	7	0	0	0	0	0	3	5	4	2	0	37.0	3.3
30	12	4	10	6	0	0	4	0	0	3	0	0	2	0	41.0	4.0
31	12	9	10	7	0	0	4	0	2	3	5	6	2	0	60.0	4.0
32	0	2	10	2	1	0	4	0	0	0	5	4	0	0	28.0	2.9
33	12	10	10	13	5	0	0	0	0	6	5	6	0	0	67.0	4.9
34	12	0	10	4	1	0	0	0	0	0	0	6	3	4	40.0	4.0
35	10	0	10	0	0	0	0	0	0	0	0	0	0	0	20.0	3.6
36	12	0	6	0	2	0	4	0	4	0	5	6	0	3	42.0	3.5
37	8	5	2	3	0	0	4	0	0	4	0	0	1	0	27.0	2.5
38	10	3	6	0	0	0	4	0	0	0	5	3	1	2	34.0	3.0
39	3	0	7	0	0	0	0	0	0	0	0	0	0	0	10.0	2.0
40	7	3	4	7	2	4	4	0	0	0	5	6	4	3	49.0	2.4
41	10	0	3	2	0	0	0	0	0	2	5	0	0	0	22.0	2.9
42	12	4	9	2	0	0	0	7	6	0	5	6	0	0	51.0	4.0
43	0	0	2	0	0	0	4	0	0	0	5	0	3	0	14.0	1.8
44	10	0	10	7	6	0	4	0	0	6	0	6	0	0	49.0	3.9
45	3	0	5	13	1	2	4	5	0	0	5	2	0	0	40.0	3.5
46	10	0	10	4	0	0	0	0	0	6	5	0	0	0	35.0	3.8
47	12	3	10	5	2	4	2	0	6	0	6	2	0	0	52.0	3.8
48	11	3	9	4	0	0	4	0	0	3	5	6	4	0	49.0	3.5
49	11	4	10	3	0	0	4	0	4	3	5	6	5	5	60.0	3.3
50	12	4	10	7	1	0	0	0	2	6	5	6	6	0	59.0	3.9
51	12	0	4	2	6	4	4	0	0	3	5	4	0	0	44.0	3.3
52	12	5	8	7	2	4	0	0	0	0	0	6	3	4	51.0	3.7
53	11	7	10	8	4	4	0	1	4	3	5	4	4	3	68.0	3.1
54	7	0	2	4	0	0	0	0	0	6	5	1	0	0	25.0	2.6
55	12	6	10	8	5	0	4	7	6	6	0	4	3	0	71.0	3.6
56	12	4	10	7	5	0	4	7	6	6	5	6	5	0	77.0	3.2

							Group II (CR items)									
Student	1.1(())	1.2(11)	2.1(10)	2.2(13)	2.3.1(6)	2.3.2(4)	2.4(4)	3.1(7)	3.2(6)	3.3.1(6)	3.3.2(5)	4.1(6)	4.2(15)	4.3(5)	Means st	SD st
57	12	7	10	7	1	0	4	0	0	0	5	6	0	5	57.0	4.0
58	7	0	10	7	1	0	4	0	0	6	5	0	2	0	42.0	3.4
59	12	0	10	7	1	2	0	0	4	3	5	6	4	4	58.0	3.7
60	11	3	3	7	3	4	0	0	0	6	5	0	0	5	47.0	3.3
61	12	3	10	7	2	0	4	2	0	6	5	6	0	1	58.0	3.8
62	12	7	10	4	6	4	4	0	5	6	5	6	0	0	69.0	3.5
63	12	0	10	7	2	2	4	0	0	5	1	5	12	0	60.0	4.4
64	12	7	10	7	0	0	4	0	0	0	0	0	0	0	40.0	4.3
65	12	3	10	7	1	0	4	6	0	0	5	2	2	5	57.0	3.7
66	12	0	2	0	0	0	4	0	0	0	0	0	2	0	20.0	3.3
67	12	3	10	7	4	4	4	4	6	5	0	6	0	0	65.0	3.5
68	12	0	10	7	1	0	4	0	0	6	0	6	4	5	55.0	4.0
69	12	0	10	0	2	0	0	0	0	0	5	6	0	0	35.0	4.1
70	12	4	2	2	2	0	4	0	0	0	5	5	2	0	38.0	3.3
71	7	3	2	2	2	0	4	0	0	6	0	6	2	0	34.0	2.5
72	12	3	4	7	1	0	0	0	0	3	5	0	0	0	35.0	3.6
73	10	4	6	0	0	0	0	0	0	6	5	5	2	4	42.0	3.2
74	12	0	10	6	2	0	4	0	0	0	5	6	2	0	47.0	4.0
75	12	0	10	7	3	0	0	0	2	0	0	6	2	0	42.0	4.1
76	8	0	10	7	0	0	4	7	0	6	0	6	0	2	50.0	3.7
77	12	5	10	7	0	0	4	0	0	4	0	0	0	2	44.0	4.1
78	12	0	9	2	6	0	4	0	6	6	0	6	0	0	51.0	4.0
79	6	9	10	0	4	0	4	0	0	0	0	6	1	5	45.0	3.6
80	4	3	6	2	2	2	4	0	0	3	5	6	3	0	40.0	2.0
81	12	7	3	2	0	0	4	0	0	6	5	6	3	0	48.0	3.5
82	10	9	10	6	2	4	0	0	0	6	5	0	2	5	59.0	3.7
83	7	5	6	4	4	2	4	1	0	3	0	6	1	0	43.0	2.4
84	12	3	10	13	1	0	4	0	4	6	5	6	9	0	73.0	4.4
85	9	9	10	6	4	4	1	2	6	5	4	0	8	0	68.0	3.3

Group II (CR items)																
Student	1.1(())	1.2(11)	2.1(10)	2.2(13)	2.3.1(6)	2.3.2(4)	2.4(4)	3.1(7)	3.2(6)	3.3.1(6)	3.3.2(5)	4.1(6)	4.2(15)	4.3(5)	Means st	SD st
86	12	0	10	5	1	0	4	0	6	0	0	0	0	0	38.0	4.1
87	12	0	10	3	1	0	4	0	6	6	5	0	2	0	49.0	3.9
88	12	0	10	7	2	4	4	0	4	6	5	6	0	0	60.0	3.8
89	12	11	4	7	0	0	0	7	6	0	5	0	0	0	52.0	4.4
90	12	9	10	2	1	4	0	7	6	0	0	6	2	0	59.0	4.1
91	12	7	6	7	6	0	4	7	6	3	5	0	0	0	63.0	3.6
92	12	11	10	0	0	4	0	0	6	0	0	0	0	0	43.0	4.7
93	12	7	10	3	2	4	4	0	0	6	5	6	4	0	63.0	3.6
94	6	0	10	2	3	4	4	0	0	0	5	6	2	5	47.0	3.0
95	12	3	3	4	5	0	4	0	0	0	0	6	0	0	37.0	3.5
96	6	11	10	6	4	4	4	0	0	6	0	6	5	5	67.0	3.3
97	12	11	10	7	0	0	4	0	0	6	0	5	0	0	55.0	4.6
98	12	7	10	7	1	0	0	0	0	3	5	6	0	5	56.0	4.1
99	12	7	10	13	0	0	4	0	0	6	0	0	0	5	57.0	4.9
100	12	11	10	13	4	4	4	0	6	6	0	6	0	2	78.0	4.5
101	8	0	10	9	4	4	4	0	4	5	5	6	0	0	59.0	3.4
102	12	6	10	6	1	4	4	7	0	3	5	6	0	3	67.0	3.5
103	7	7	10	3	3	0	4	0	0	0	5	0	0	0	39.0	3.4
104	6	0	9	2	1	0	4	0	0	6	5	6	0	0	39.0	3.1
105	3	0	6	3	1	0	1	0	0	0	5	6	7	3	35.0	2.6
106	12	8	10	7	6	4	4	0	2	3	5	6	0	5	72.0	3.4
107	12	9	10	7	5	4	4	0	4	6	5	6	2	0	74.0	3.5
108	12	5	10	7	1	0	0	0	0	6	5	6	0	3	55.0	4.0
109	12	4	10	7	4	2	4	0	6	3	5	6	0	0	63.0	3.6
110	12	3	10	2	5	0	0	0	4	3	5	6	0	3	53.0	3.7
111	12	4	10	7	6	0	0	0	0	6	5	6	0	5	61.0	3.9
112	12	9	10	13	4	4	4	0	6	0	5	5	0	0	72.0	4.5
113	4	0	10	7	1	0	4	0	0	6	5	6	3	0	46.0	3.2
114	12	8	10	10	0	4	4	0	0	3	0	6	2	0	59.0	4.3
115	12	11	10	2	3	2	4	0	0	0	5	5	4	5	63.0	4.0

Group II (CR items)																
Student	1.1(())	1.2(11)	2.1(10)	2.2(13)	2.3.1(6)	2.3.2(4)	2.4(4)	3.1(7)	3.2(6)	3.3.1(6)	3.3.2(5)	4.1(6)	4.2(15)	4.3(5)	Means st	SD st
116	12	8	10	7	2	4	4	0	0	3	5	4	2	0	61.0	3.7
117	12	4	10	7	1	0	4	4	6	0	0	4	0	0	52.0	3.9
118	12	0	10	13	2	4	0	0	0	5	6	6	10	0	68.0	4.8
119	12	11	6	3	4	4	4	1	6	6	5	6	8	3	79.0	3.0
120	12	11	10	7	4	0	0	2	0	3	5	6	2	3	65.0	4.1
121	12	3	10	7	4	0	4	0	0	3	5	6	7	3	64.0	3.6
122	4	0	10	7	0	0	4	0	0	6	0	6	2	3	42.0	3.3
123	6	4	10	7	1	0	0	0	0	6	5	6	5	0	50.0	3.3
124	12	7	10	7	0	0	0	0	4	6	0	6	10	5	67.0	4.2
125	12	0	10	7	0	4	4	5	2	0	0	5	0	1	50.0	3.9
126	12	11	10	7	0	4	4	0	0	6	0	6	3	3	66.0	4.2
127	3	3	10	0	0	0	4	0	0	0	0	6	2	2	30.0	3.0
128	12	7	10	3	5	2	4	0	0	6	5	6	6	0	66.0	3.6
129	12	3	10	9	0	2	0	0	4	6	5	6	0	0	57.0	4.1
130	0	3	10	10	4	0	4	0	4	6	0	6	3	5	55.0	3.4
131	3	3	5	2	0	2	4	4	6	5	2	0	0	0	36.0	2.1
132	0	0	10	10	1	0	0	0	0	5	5	6	0	0	37.0	3.8
133	12	3	10	13	0	0	0	0	0	0	0	0	0	0	38.0	5.0
134	12	0	10	10	2	4	0	0	8	3	0	6	3	0	58.0	4.3
135	12	9	6	2	1	4	0	0	6	6	5	6	0	0	57.0	3.8
136	4	3	10	0	0	0	4	5	0	0	0	2	0	0	28.0	3.0
137	12	3	10	10	2	4	0	0	4	6	5	6	4	4	70.0	3.6
138	12	0	10	4	0	0	0	0	0	0	0	5	2	0	33.0	4.0
139	6	3	10	7	0	2	4	0	0	3	5	6	4	0	50.0	3.1
140	12	8	10	7	0	0	0	7	6	6	5	6	0	0	67.0	4.1
141	1	3	10	7	2	2	4	0	2	6	5	6	3	0	51.0	2.9
142	4	3	10	7	2	0	0	0	2	0	5	6	2	0	41.0	3.1
143	0	0	10	4	2	4	0	0	4	6	5	6	3	3	47.0	2.9
144	0	3	7	2	0	0	4	0	6	3	0	6	0	0	31.0	2.6
145	10	3	10	3	2	4	4	0	6	0	0	6	0	4	52.0	3.4

Group II (CR items)																
Student	1.1(())	1.2(11)	2.1(10)	2.2(13)	2.3.1(6)	2.3.2(4)	2.4(4)	3.1(7)	3.2(6)	3.3.1(6)	3.3.2(5)	4.1(6)	4.2(15)	4.3(5)	Means st	SD st
146	12	0	10	5	3	5	4	0	4	0	0	6	0	5	54.0	3.8
147	3	0	10	3	3	2	4	0	0	6	0	5	3	0	39.0	2.9
148	9	3	10	7	4	4	4	0	0	6	0	0	0	5	52.0	3.5
149	3	0	5	2	0	0	0	0	0	0	0	6	2	0	18.0	2.1
150	0	0	7	7	0	0	0	0	0	6	0	0	0	0	20.0	2.8
151	10	3	10	7	3	0	0	0	0	3	5	6	5	0	52.0	3.6
152	0	3	10	0	6	0	4	7	6	0	5	6	3	0	50.0	3.3
153	12	0	6	3	5	4	4	0	0	6	5	6	7	2	60.0	3.3
154	12	6	10	7	1	0	4	0	0	0	0	6	0	0	46.0	4.2
155	12	2	6	0	0	4	0	0	5	0	0	0	0	0	29.0	3.6
156	5	3	2	0	0	0	0	0	0	3	5	0	0	0	18.0	1.9
157	3	3	10	13	2	0	4	0	6	5	6	0	0	0	52.0	4.0
158	12	3	10	0	1	0	0	0	2	0	5	5	0	0	38.0	4.0
159	3	0	2	7	0	0	0	0	4	6	5	5	0	5	37.0	2.6
160	7	0	3	7	0	2	4	0	6	0	0	6	0	0	35.0	2.9
161	12	0	4	3	1	0	4	0	0	0	0	5	0	3	32.0	3.4
162	12	4	10	0	6	4	4	0	0	0	5	2	0	3	50.0	3.8
163	2	3	10	7	4	4	0	4	1	0	0	6	10	3	54.0	3.4
164	1	6	10	7	2	0	4	0	0	6	5	6	12	3	62.0	3.7
165	10	0	10	2	0	0	4	0	2	0	5	0	0	0	33.0	3.6
166	1	0	3	0	4	6	2	0	0	0	0	0	0	0	16.0	1.9
167	2	9	7	3	4	0	4	0	4	6	0	6	7	0	52.0	3.0
168	12	8	10	7	0	0	4	1	6	6	5	6	2	5	72.0	3.6
169	12	10	10	7	1	4	4	0	6	6	5	6	0	3	74.0	3.7
170	0	11	10	13	4	4	4	7	6	6	5	5	2	0	77.0	3.8
171	12	5	5	3	3	0	4	0	4	3	5	4	0	3	51.0	3.0
172	8	0	10	13	2	4	4	0	6	6	5	6	5	3	72.0	3.6
173	12	11	10	7	6	0	4	7	4	6	5	6	4	5	54.0	3.4
174	12	11	10	7	6	4	4	6	8	5	7	6	5	5	96.0	2.5
175	9	3	10	3	6	0	0	0	4	0	0	4	3	5	47.0	3.3

Group II (CR items)																
Student	1.1(())	1.2(11)	2.1(10)	2.2(13)	2.3.1(6)	2.3.2(4)	2.4(4)	3.1(7)	3.2(6)	3.3.1(6)	3.3.2(5)	4.1(6)	4.2(15)	4.3(5)	Means st	SD st
176	12	7	10	7	6	4	0	0	4	7	6	6	12	6	87.0	3.6
177	12	11	10	13	6	4	4	0	6	6	5	6	15	4	102.0	4.2
178	9	4	10	8	2	4	4	0	0	6	5	6	2	0	60.0	3.3
179	12	7	10	13	6	4	4	6	6	2	5	6	4	3	88.0	3.3
180	11	9	6	10	7	3	4	3	6	5	0	4	5	7	80.0	3.0
181	12	11	10	13	6	4	4	7	6	6	5	6	15	5	110.0	3.6
182	12	11	10	7	6	4	0	0	6	5	6	0	0	0	67.0	4.3
183	12	7	10	13	6	4	4	1	0	6	5	6	14	0	88.0	4.6
184	12	11	10	7	6	4	4	7	6	6	5	6	0	4	88.0	3.1
185	12	11	10	7	4	4	4	0	0	6	5	6	11	4	84.0	3.8
186	12	11	10	7	2	4	4	0	6	6	5	5	2	0	74.0	3.8
187	9	11	10	7	6	4	0	7	6	6	5	0	12	3	86.0	3.7
188	12	11	10	10	3	2	4	0	4	3	0	6	6	0	71.0	4.2
189	12	11	2	0	4	4	0	7	6	6	5	6	0	0	63.0	3.9
190	12	4	3	10	6	4	4	0	6	3	0	6	2	5	65.0	3.3
191	4	3	10	9	2	4	4	0	0	6	5	2	0	0	49.0	3.2
192	12	8	10	7	3	0	0	0	4	6	0	6	9	3	68.0	4.1
193	12	11	10	13	5	2	4	6	5	0	0	0	0	0	68.0	4.9
194	12	7	10	13	1	2	4	0	0	6	5	5	2	0	67.0	4.4
195	12	11	0	0	8	0	5	0	0	0	0	6	0	0	42.0	4.5
196	12	3	4	6	1	0	4	7	6	0	5	6	0	2	56.0	3.4
197	10	11	10	7	4	0	4	7	5	6	5	6	4	5	84.0	2.9
198	12	7	10	13	2	4	7	0	6	6	5	6	10	5	93.0	3.6
199	12	11	10	7	5	4	4	7	6	3	5	5	15	3	97.0	3.7
200	12	11	10	13	5	4	4	6	6	6	5	6	15	5	108.0	3.7
201	12	8	10	13	6	4	4	6	6	6	5	6	6	0	92.0	3.3
202	12	7	10	0	4	2	4	0	0	3	5	0	0	0	47.0	4.0
203	12	11	10	7	5	0	4	7	6	6	5	6	2	3	84.0	3.4
204	12	11	10	13	6	4	4	7	6	6	5	6	15	5	110.0	3.6

						Group II (CR items)										
Student	1.1(())	1.2(11)	2.1(10)	2.2(13)	2.3.1(6)	2.3.2(4)	2.4(4)	3.1(7)	3.2(6)	3.3.1(6)	3.3.2(5)	4.1(6)	4.2(15)	4.3(5)	Means st	SD st
205	12	11	10	7	2	2	4	7	6	6	5	6	15	3	96.0	3.9
206	12	11	10	13	0	4	4	7	6	6	5	5	14	3	100.0	4.2
207	12	0	10	7	0	4	4	0	0	6	5	5	0	3	56.0	3.9
208	10	0	10	7	0	0	0	0	0	6	5	4	0	0	42.0	3.9
209	11	3	10	7	5	4	4	0	3	6	5	4	10	0	72.0	3.4
210	12	9	10	7	1	0	4	7	2	6	5	6	15	5	89.0	4.2
211	12	2	10	7	2	0	6	0	0	0	5	0	2	0	46.0	4.1
212	12	5	10	4	4	4	4	0	0	6	2	6	5	2	64.0	3.3
213	12	11	10	9	2	4	0	6	6	0	5	6	4	3	78.0	3.8
214	12	3	10	4	3	0	4	0	4	6	0	6	0	0	52.0	3.8
215	11	11	10	4	5	0	4	0	3	6	5	6	0	5	70.0	3.7
216	12	11	10	7	6	4	0	7	6	6	5	6	15	5	100.0	3.8
217	12	9	10	13	5	4	4	7	0	0	0	6	15	5	90.0	4.9
218	12	5	0	7	3	0	4	0	0	6	5	6	0	0	48.0	3.7
219	12	3	10	7	2	0	4	0	4	6	5	6	0	0	59.0	3.8
220	12	3	10	7	3	4	4	0	0	6	5	3	3	4	64.0	3.3
221	12	9	10	13	6	4	4	7	6	6	5	6	15	5	108.0	3.5
222	12	5	10	4	2	4	4	0	6	3	5	6	7	3	71.0	3.1
223	12	3	10	7	4	4	4	2	2	0	5	4	3	0	60.0	3.4
224	12	11	10	13	6	4	4	2	6	6	5	6	15	5	105.0	3.9
225	12	3	10	7	2	2	4	0	1	6	0	2	0	0	49.0	3.9
226	11	9	10	3	2	0	4	6	6	6	0	6	2	5	70.0	3.4
227	12	11	10	7	4	2	0	0	1	6	5	0	0	0	58.0	4.4
228	7	11	10	7	4	0	4	1	6	6	5	6	0	0	67.0	3.6
229	12	7	10	6	2	0	4	7	6	6	5	6	15	0	86.0	4.2
230	12	7	10	7	1	0	4	0	0	1	5	0	0	0	47.0	4.2
231	12	11	10	7	2	0	4	0	5	6	5	6	4	0	72.0	3.9
232	11	7	10	7	6	4	0	2	4	6	5	6	2	5	75.0	3.0
233	12	5	10	7	4	4	4	0	4	0	5	6	2	0	63.0	3.5
234	12	7	10	7	4	4	4	7	6	6	5	6	15	5	98.0	3.2

Group II (CR items)																
Student	1.1(())	1.2(11)	2.1(10)	2.2(13)	2.3.1(6)	2.3.2(4)	2.4(4)	3.1(7)	3.2(6)	3.3.1(6)	3.3.2(5)	4.1(6)	4.2(15)	4.3(5)	Means st	SD st
235	12	11	10	7	4	0	4	7	6	6	5	6	2	0	80.0	3.7
236	12	11	10	13	6	4	4	7	0	6	0	6	4	5	88.0	4.0
237	10	7	10	6	6	4	4	0	2	4	0	6	4	4	67.0	3.0
238	12	11	10	6	4	4	4	7	6	6	5	6	2	3	86.0	3.0
239	12	11	10	13	4	4	4	7	6	6	5	6	15	5	108.0	3.7
240	12	7	10	7	4	0	4	7	6	6	5	6	2	4	80.0	3.0
241	12	7	10	7	4	4	4		0	6	5	6	10	4	79.0	3.2
242	12	9	10	7	1	4	0	6	0	0	0	6	6	4	65.0	4.0
243	12	11	10	7	6	4	4	7	6	6	5	6	2	3	89.0	2.9
244	12	7	10	7	6	4	4	5	0	6	5	6	15	2	89.0	3.9
245	12	11	10	12	4	4	4	6	7	6	5	6	15	5	107.0	3.6
246	12	4	10	6	4	4	4	0	6	6	5	6	4	5	76.0	2.8
247	12	9	10	6	6	4	4	7	6	6	5	6	13	5	99.0	2.8
248	12	10	10	2	6	4	4	7	6	3	5	6	15	3	93.0	3.8
249	12	8	10	7	4	0	4	7	6	6	5	6	15	5	95.0	3.7
250	12	11	10	13	6	4	4	7	6	6	5	6	7	5	102.0	3.0
251	12	11	10	7	2	0	4	0	0	6	0	6	0	0	58.0	4.5
252	12	11	10	13	6	4	4	7	4	6	5	6	15	2	105.0	4.0
253	12	11	10	7	3	4	4	7	6	6	5	6	4	5	90.0	2.8
254	12	11	10	13	6	4	4	7	6	6	5	6	15	5	110.0	3.6
255	12	5	10	7	4	4	4	0	0	6	5	6	12	0	75.0	4.0
256	12	9	10	7	6	4	4	0	0	0	0	6	0	0	58.0	4.3
257	12	8	10	7	5	0	4	7	6	6	5	6	0	5	81.0	3.2
258	12	11	6	5	4	4	0	6	6	6	0	6	0	3	69.0	3.6
259	12	11	10	10	2	0	4	7	6	6	5	6	7	5	91.0	3.4
260	12	9	10	13	3	0	4	7	6	6	5	6	4	5	90.0	3.5
261	12	7	10	13	4	2	0	7	6	6	0	6	15	5	93.0	4.6
262	12	11	10	7	6	4	4	7	6	6	5	6	15	5	104.0	3.3
263	12	4	10	13	2	4	4	1	6	6	5	5	0	0	72.0	4.1
264	12	7	10	12	6	4	4	0	6	6	5	6	15	5	98.0	3.9

Group II (CR items)																
Student	1.1(())	1.2(11)	2.1(10)	2.2(13)	2.3.1(6)	2.3.2(4)	2.4(4)	3.1(7)	3.2(6)	3.3.1(6)	3.3.2(5)	4.1(6)	4.2(15)	4.3(5)	Means st	SD st
265	5	3	10	13	6	4	0	7	0	6	5	6	5	3	73.0	3.4
266	12	9	10	13	2	0	4	7	6	6	5	6	15	5	100.0	4.2
267	12	11	10	13	6	4	4	4	0	6	5	6	4	5	90.0	3.7
268	12	11	10	13	6	4	4	7	6	6	5	6	15	5	110.0	3.6
269	12	0	10	7	2	0	4	0	4	6	5	6	9	5	70.0	3.7
270	12	11	10	7	4	4	6	1	5	6	5	6	9	3	89.0	3.2
271	6	3	10	7	4	4	4	0	2	0	5	6	7	5	63.0	2.7
272	12	11	10	13	4	4	4	7	6	6	5	6	15	5	108.0	3.7
273	12	11	10	0	5	0	4	0	4	6	5	6	9	0	72.0	4.2
274	10	4	10	7	7	4	4	4	6	6	5	6	10	3	86.0	2.4
275	12	11	10	0	4	4	4	7	6	6	5	6	15	2	92.0	4.1
276	12	8	10	10	4	4	4	0	6	6	5	6	7	3	85.0	3.2
277	12	7	10	13	4	4	0	0	0	3	5	6	10	3	77.0	4.4
278	12	11	10	13	6	4	4	7	6	3	5	6	15	3	105.0	4.0
279	12	7	10	7	4	0	4	7	6	6	5	6	15	0	89.0	4.1
280	11	4	2	2	2	2	4	0	2	3	5	6	0	0	43.0	2.9
281	0	0	10	7	0	0	0	0	0	3	5	6	0	0	31.0	3.4
282	12	11	10	7	6	4	4	0	6	6	0	6	2	3	77.0	3.7
283	3	11	10	13	4	4	0	7	6	6	0	6	15	5	90.0	4.5
284	12	9	10	7	2	0	4	0	2	6	5	6	7	5	75.0	3.6
285	11	7	10	7	4	4	4	0	6	0	5	6	2	5	71.0	3.2
286	12	11	10	13	4	4	4	2	6	6	5	6	15	3	101.0	4.2
287	12	3	10	7	0	0	4	0	6	6	0	2	4	5	59.0	3.8
288	11	11	10	7	1	2	4	0	6	6	5	6	15	5	89.0	4.2
289	12	3	10	7	0	0	0	0	4	2	5	6	0	2	51.0	3.9
290	12	11	10	13	6	4	4	7	6	6	5	6	15	5	110.0	3.6
291	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4.0	1.1
292	10	4	10	2	0	0	0	0	0	6	5	5	2	0	44.0	3.6
293	11	8	10	7	6	0	0	0	2	6	0	6	4	5	65.0	3.8

Group II (CR items)																
Student	1.1(())	1.2(11)	2.1(10)	2.2(13)	2.3.1(6)	2.3.2(4)	2.4(4)	3.1(7)	3.2(6)	3.3.1(6)	3.3.2(5)	4.1(6)	4.2(15)	4.3(5)	Means st	SD st
294	12	11	10	13	0	4	4	7	6	6	5	6	15	3	102.0	4.3
295	11	0	10	6	0	0	0	0	6	6	5	6	15	0	65.0	4.9
296	12	0	10	6	4	4	4	0	4	6	5	6	4	2	67.0	3.3
297	10	0	10	9	0	0	4	0	6	6	5	6	2	5	63.0	3.7
298	5	11	10	7	6	2	4	0	0	0	5	6	15	5	76.0	4.4
299	12	11	10	7	3	4	0	7	6	6	5	6	3	3	83.0	3.4
300	12	9	10	7	4	0	4	0	0	6	0	2	15	5	74.0	4.8
301	0	3	10	3	0	0	4	0	2	3	5	6	4	0	40.0	2.9
302	6	11	10	7	3	0	4	0	0	0	0	6	2	3	52.0	3.8
303	12	10	10	6	4	4	4	1	2	6	5	6	2	0	72.0	3.5
304	12	11	10	7	0	4	0	7	6	6	5	5	15	5	93.0	4.2
305	12	0	10	7	3	0	4	7	4	6	5	2	7	0	67.0	3.7
306	12	6	10	7	6	4	4	0	6	6	0	6	1	0	68.0	3.7
307	12	5	10	13	6	4	4	7	6	6	5	6	2	5	91.0	3.1
308	12	11	10	7	6	4	4	7	6	6	5	6	15	5	104.0	3.3
309	12	10	10	13	6	0	4	7	6	6	5	6	8	5	98.0	3.4
310	11	0	10	13	3	4	4	7	6	6	5	6	12	0	87.0	4.1
311	12	11	10	7	5	4	4	7	6	6	5	6	15	0	98.0	3.8
312	12	3	10	7	5	4	4	0	4	3	0	6	0	4	62.0	3.5
313	9	10	7	10	4	4	0	2	0	0	0	6	7	5	64.0	3.8
314	12	3	10	7	6	4	4	7	6	6	5	6	15	5	96.0	3.3
315	12	4	10	7	4	4	4	0	6	6	5	6	15	3	86.0	3.9
316	12	11	10	13	6	4	4	7	6	6	5	6	5	3	98.0	3.2
317	12	8	10	7	6	4	0	1	0	6	6	12	3	7	82.0	4.0
Means item	10.0	5.7	8.9	6.6	2.9	6.3	2.9	2.1	2.9	4.0	3.6	4.8	4.3	2.1	49.1	0.0
SD item	3.6	4.1	2.5	3.8	2.2	3.8	1.8	3.0	2.7	2.5	2.4	2.3	5.2	2.2		

Table 6.57. Data of 317 examinees grades in Group III (lab CR items), Chemistry Exam 1st Phase. 2004.

Group III (CR items)						
Student	1(7)	2(10)	3(5)	4(())	Means st	SD st
1	0	7	0	8	15.0	4.3
2	0	7	0	0	7.0	3.5
3	0	7	0	4	11.0	3.4
4	0	7	5	0	12.0	3.6
5	7	5	5	8	25.0	1.5
6	0	10	0	8	18.0	5.3
7	0	5	0	4	9.0	2.6
8	0	5	0	4	9.0	2.6
9	0	5	0	8	13.0	3.9
10	0	5	5	4	14.0	2.4
11	0	7	0	4	11.0	3.4
12	0	3	0	0	3.0	1.5
13	0	10	5	4	19.0	4.1
14	0	10	0	8	18.0	5.3
15	0	10	5	8	23.0	4.3
16	0	7	0	0	7.0	3.5
17	7	7	0	8	22.0	3.7
18	0	5	0	0	5.0	2.5
19	0	7	0	4	11.0	3.4
20	0	3	0	4	7.0	2.1
21	0	5	0	8	13.0	3.9
22	0	0	0	0	0.0	0.0
23	0	5	0	0	5.0	2.5
24	0	10	0	4	14.0	4.7
25	0	7	0	4	11.0	3.4
26	0	7	0	4	11.0	3.4
27	0	5	0	0	5.0	2.5
28	0	5	5	0	10.0	2.9
29	0	5	0	0	5.0	2.5
30	0	0	0	0	0.0	0.0
31	0	5	0	0	5.0	2.5
32	0	5	0	0	5.0	2.5
33	0	5	4	4	13.0	2.2
34	0	5	0	0	5.0	2.5
35	3	0	0	0	3.0	1.5
36	7	7	0	8	22.0	3.7
37	0	5	0	0	5.0	2.5
38	0	5	0	0	5.0	2.5
39	0	5	0	0	5.0	2.5

Group III (CR items)						
Student	1(7)	2(10)	3(5)	4(())	Means st	SD st
40	7	10	0	0	17.0	5.1
41	0	1	0	0	1.0	0.5
42	0	1	0	0	1.0	0.5
43	0	5	0	0	5.0	2.5
44	0	7	0	8	15.0	4.3
45	0	7	0	0	7.0	3.5
46	0	7	0	0	7.0	3.5
47	0	5	0	4	9.0	2.6
48	0	5	5	0	10.0	2.9
49	0	5	0	4	9.0	2.6
50	7	7	0	8	22.0	3.7
51	7	5	5	4	21.0	1.3
52	0	10	0	0	10.0	5.0
53	7	1	0	0	8.0	3.4
54	0	10	0	0	10.0	5.0
55	0	5	5	4	14.0	2.4
56	0	3	5	0	8.0	2.4
57	0	10	0	0	10.0	5.0
58	0	0	5	8	13.0	3.9
59	0	7	0	0	7.0	3.5
60	0	0	5	0	5.0	2.5
61	0	7	0	0	7.0	3.5
62	0	7	5	0	12.0	3.6
63	0	7	0	8	15.0	4.3
64	0	10	0	0	10.0	5.0
65	0	3	0	0	3.0	1.5
66	0	3	0	0	3.0	1.5
67	5	10	0	0	15.0	4.8
68	0	5	5	0	10.0	2.9
69	0	1	5	8	14.0	3.7
70	7	7	0	0	14.0	4.0
71	0	3	5	0	8.0	2.4
72	0	0	0	0	0.0	0.0
73	0	3	0	0	3.0	1.5
74	0	5	0	0	5.0	2.5
75	0	5	5	0	10.0	2.9
76	7	7	5	0	19.0	3.3
77	0	5	0	0	5.0	2.5
78	7	7	5	0	19.0	3.3
79	0	10	0	4	14.0	4.7
80	0	7	0	0	7.0	3.5
81	0	7	5	0	12.0	3.6

Group III (CR items)						
Student	1(7)	2(10)	3(5)	4(())	Means st	SD st
82	0	3	5	0	8.0	2.4
83	0	5	4	0	9.0	2.6
84	0	7	5	4	16.0	2.9
85	0	5	5	8	18.0	3.3
86	0	3	0	0	3.0	1.5
87	0	7	0	0	7.0	3.5
88	0	10	0	0	10.0	5.0
89	7	7	5	4	23.0	1.5
90	7	7	0	0	14.0	4.0
91	7	10	0	0	17.0	5.1
92	0	5	0	0	5.0	2.5
93	0	10	0	8	18.0	5.3
94	0	7	0	8	15.0	4.3
95	0	10	0	0	10.0	5.0
96	0	7	5	0	12.0	3.6
97	0	7	0	0	7.0	3.5
98	0	5	0	8	13.0	3.9
99	0	10	0	0	10.0	5.0
100	0	10	0	8	18.0	5.3
101	7	10	0	8	25.0	4.3
102	0	10	0	0	10.0	5.0
103	0	7	0	4	11.0	3.4
104	0	10	5	8	23.0	4.3
105	0	10	0	0	10.0	5.0
106	7	7	5	8	27.0	1.3
107	0	10	5	0	15.0	4.8
108	0	10	5	0	15.0	4.8
109	0	10	0	0	10.0	5.0
110	0	3	0	4	7.0	2.1
111	0	10	0	0	10.0	5.0
112	7	10	0	0	17.0	5.1
113	0	10	0	0	10.0	5.0
114	0	1	0	0	1.0	0.5
115	7	3	0	0	10.0	3.3
116	0	5	5	0	10.0	2.9
117	0	3	0	0	3.0	1.5
118	7	7	0	0	14.0	4.0
119	0	10	0	8	18.0	5.3
120	0	7	5	8	20.0	3.6
121	7	5	0	0	12.0	3.6
122	0	10	0	0	10.0	5.0
123	0	7	5	4	16.0	2.9

Group III (CR items)						
Student	1(7)	2(10)	3(5)	4(())	Means st	SD st
124	0	7	0	8	15.0	4.3
125	0	0	0	0	0.0	0.0
126	0	10	0	0	10.0	5.0
127	0	3	5	8	16.0	3.4
128	0	1	0	4	5.0	1.9
129	0	5	0	8	13.0	3.9
130	0	7	0	0	7.0	3.5
131	0	0	0	0	0.0	0.0
132	0	0	0	8	8.0	4.0
133	0	10	0	0	10.0	5.0
134	0	7	0	0	7.0	3.5
135	0	7	0	8	15.0	4.3
136	0	5	0	0	5.0	2.5
137	0	7	0	0	7.0	3.5
138	0	5	0	0	5.0	2.5
139	0	1	5	0	6.0	2.4
140	0	5	0	0	5.0	2.5
141	0	5	0	0	5.0	2.5
142	0	7	0	8	15.0	4.3
143	0	10	0	0	10.0	5.0
144	0	5	0	0	5.0	2.5
145	0	5	0	0	5.0	2.5
146	0	7	0	4	11.0	3.4
147	0	10	0	0	10.0	5.0
148	0	3	0	0	3.0	1.5
149	0	1	0	0	1.0	0.5
150	0	0	0	0	0.0	0.0
151	0	3	0	0	3.0	1.5
152	0	5	0	0	5.0	2.5
153	0	5	0	0	5.0	2.5
154	0	0	0	0	0.0	0.0
155	0	5	0	2	7.0	2.4
156	0	5	0	0	5.0	2.5
157	0	3	0	0	3.0	1.5
158	0	3	0	8	11.0	3.8
159	0	10	0	0	10.0	5.0
160	0	10	0	0	10.0	5.0
161	0	3	0	0	3.0	1.5
162	0	5	5	0	10.0	2.9
163	0	3	0	0	3.0	1.5
164	0	5	0	0	5.0	2.5
165	0	7	0	0	7.0	3.5

Group III (CR items)						
Student	1(7)	2(10)	3(5)	4(())	Means st	SD st
166	0	10	5	8	23.0	4.3
167	0	1	0	8	9.0	3.9
168	7	5	0	8	20.0	3.6
169	7	1	0	5	13.0	3.3
170	0	5	0	8	13.0	3.9
171	0	5	0	0	5.0	2.5
172	5	5	0	0	10.0	2.9
173	0	10	5	8	23.0	4.3
174	7	7	0	8	22.0	3.7
175	0	10	5	4	19.0	4.1
176	0	10	5	4	19.0	4.1
177	7	10	5	8	30.0	2.1
178	0	10	0	8	18.0	5.3
179	7	10	5	0	22.0	4.2
180	0	3	5	8	16.0	3.4
181	7	7	5	8	27.0	1.3
182	0	10	5	8	23.0	4.3
183	0	5	5	8	18.0	3.3
184	0	10	5	8	23.0	4.3
185	0	7	0	4	11.0	3.4
186	0	10	5	8	23.0	4.3
187	7	10	5	8	30.0	2.1
188	0	5	5	4	14.0	2.4
189	0	7	5	8	20.0	3.6
190	0	10	0	8	18.0	5.3
191	0	5	0	8	13.0	3.9
192	0	5	0	0	5.0	2.5
193	0	5	5	0	10.0	2.9
194	7	7	5	8	27.0	1.3
195	0	0	0	0	0.0	0.0
196	0	7	5	8	20.0	3.6
197	0	10	0	8	18.0	5.3
198	7	10	0	8	25.0	4.3
199	0	3	5	8	16.0	3.4
200	7	7	5	8	27.0	1.3
201	7	10	0	8	25.0	4.3
202	7	0	4	0	11.0	3.4
203	7	10	0	4	21.0	4.3
204	0	10	0	8	18.0	5.3
205	7	10	5	8	30.0	2.1
206	7	7	5	8	27.0	1.3
207	0	10	5	4	19.0	4.1

Group III (CR items)						
Student	1(7)	2(10)	3(5)	4(())	Means st	SD st
208	0	5	0	4	9.0	2.6
209	7	10	5	8	30.0	2.1
210	7	10	5	8	30.0	2.1
211	0	5	0	4	9.0	2.6
212	0	10	5	8	23.0	4.3
213	7	7	5	8	27.0	1.3
214	0	7	5	4	16.0	2.9
215	0	7	5	8	20.0	3.6
216	7	10	5	4	26.0	2.6
217	7	7	5	0	19.0	3.3
218	0	5	5	4	14.0	2.4
219	0	5	0	8	13.0	3.9
220	0	3	5	8	16.0	3.4
221	7	7	5	8	27.0	1.3
222	0	7	5	8	20.0	3.6
223	7	7	5	8	27.0	1.3
224	7	10	5	8	30.0	2.1
225	0	5	5	0	10.0	2.9
226	7	5	5	8	25.0	1.5
227	0	10	0	8	18.0	5.3
228	0	0	5	8	13.0	3.9
229	7	10	5	8	30.0	2.1
230	0	5	0	8	13.0	3.9
231	0	10	5	8	23.0	4.3
232	0	5	0	0	5.0	2.5
233	0	7	0	8	15.0	4.3
234	7	5	5	8	25.0	1.5
235	0	10	5	8	23.0	4.3
236	7	7	5	8	27.0	1.3
237	0	3	5	0	8.0	2.4
238	0	7	0	8	15.0	4.3
239	7	7	5	8	27.0	1.3
240	0	7	0	8	15.0	4.3
241	0	5	5	8	18.0	3.3
242	0	7	5	4	16.0	2.9
243	0	7	5	8	20.0	3.6
244	0	5	5	8	18.0	3.3
245	0	10	5	4	19.0	4.1
246	0	10	5	8	23.0	4.3
247	0	7	5	4	16.0	2.9
248	7	10	0	8	25.0	4.3
249	7	10	0	8	25.0	4.3

Group III (CR items)						
Student	1(7)	2(10)	3(5)	4(())	Means st	SD st
250	7	10	0	8	25.0	4.3
251	0	10	0	8	18.0	5.3
252	7	10	5	8	30.0	2.1
253	7	7	5	4	23.0	1.5
254	7	10	5	8	30.0	2.1
255	7	10	0	8	25.0	4.3
256	7	10	0	0	17.0	5.1
257	7	10	0	0	17.0	5.1
258	7	7	0	8	22.0	3.7
259	0	7	0	8	15.0	4.3
260	7	7	0	8	22.0	3.7
261	7	10	5	8	30.0	2.1
262	7	7	0	8	22.0	3.7
263	0	10	0	8	18.0	5.3
264	7	7	5	8	27.0	1.3
265	0	7	5	0	12.0	3.6
266	7	7	5	0	19.0	3.3
267	7	10	5	0	22.0	4.2
268	7	10	5	8	30.0	2.1
269	0	10	5	0	15.0	4.8
270	0	7	0	4	11.0	3.4
271	0	7	0	0	7.0	3.5
272	0	7	5	8	20.0	3.6
273	0	7	0	8	15.0	4.3
274	7	10	5	8	30.0	2.1
275	7	7	5	8	27.0	1.3
276	7	3	0	4	14.0	2.9
277	0	0	5	8	13.0	3.9
278	7	10	5	8	30.0	2.1
279	7	10	0	4	21.0	4.3
280	0	5	0	4	9.0	2.6
281	0	10	0	4	14.0	4.7
282	0	10	5	4	19.0	4.1
283	0	10	0	0	10.0	5.0
284	0	3	0	8	11.0	3.8
285	0	7	0	8	15.0	4.3
286	7	10	5	8	30.0	2.1
287	0	10	5	4	19.0	4.1
288	0	7	5	8	20.0	3.6
289	0	7	0	8	15.0	4.3
290	0	10	5	4	19.0	4.1
291	0	10	0	0	10.0	5.0

Group III (CR items)						
Student	1(7)	2(10)	3(5)	4(())	Means st	SD st
292	0	7	0	0	7.0	3.5
293	0	5	0	8	13.0	3.9
294	0	5	0	8	13.0	3.9
295	7	5	0	8	20.0	3.6
296	0	7	0	8	15.0	4.3
297	0	5	5	8	18.0	3.3
298	0	10	0	0	10.0	5.0
299	0	7	5	8	20.0	3.6
300	0	5	0	4	9.0	2.6
301	0	5	0	0	5.0	2.5
302	0	5	5	8	18.0	3.3
303	0	10	0	0	10.0	5.0
304	0	0	5	5	10.0	2.9
305	7	10	5	8	30.0	2.1
306	7	5	5	0	17.0	3.0
307	0	3	5	8	16.0	3.4
308	7	7	5	8	27.0	1.3
309	7	5	5	8	25.0	1.5
310	0	10	5	0	15.0	4.8
311	7	10	5	8	30.0	2.1
312	7	5	0	4	16.0	2.9
313	0	5	0	4	9.0	2.6
314	0	10	5	8	23.0	4.3
315	7	10	0	8	25.0	4.3
316	7	7	8	15	37.0	3.9
317	7	5	8	5	25.0	1.5
Means item	1.8	6.5	2.0	3.9	14.3	2.2
SD item	3.1	2.9	2.5	3.7		

Chemistry Exam 1st Phase, 2005

Table 6.58. Data of 382 examinees grades in Group I (MC items), Chemistry Exam 1st Phase, 2005.

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
1	10	10	10	0	10	10	83.3	4.1
2	0	0	0	0	10	0	16.7	4.1
3	0	0	10	10	10	10	66.7	5.2
4	10	10	0	0	0	0	33.3	5.2
5	10	10	10	10	10	10	100.0	0.0
6	0	0	10	0	0	10	33.3	5.2
7	10	10	10	10	10	10	100.0	0.0
8	10	10	10	10	0	10	83.3	4.1
9	0	0	10	10	10	10	66.7	5.2
10	0	10	10	10	10	0	66.7	5.2
11	10	10	0	10	10	10	83.3	4.1
12	10	10	10	10	10	0	83.3	4.1
13	0	10	0	0	10	0	33.3	5.2
14	10	10	10	10	10	10	100.0	0.0
15	10	10	10	10	0	0	66.7	5.2
16	10	10	10	10	0	0	66.7	5.2
17	10	0	0	10	0	10	50.0	5.5
18	10	10	10	10	10	10	100.0	0.0
19	0	0	0	0	0	0	0.0	0.0
20	10	0	10	10	10	10	83.3	4.1
21	0	0	0	10	10	0	33.3	5.2
22	10	10	10	0	10	0	66.7	5.2
23	0	10	10	10	10	10	83.3	4.1
24	0	0	10	10	0	0	33.3	5.2
25	10	10	10	10	10	10	100.0	0.0
26	10	10	10	0	0	0	50.0	5.5
27	10	10	10	10	10	10	100.0	0.0
28	10	0	0	0	0	0	16.7	4.1
29	10	10	0	10	0	0	50.0	5.5
30	0	0	10	10	10	10	66.7	5.2
31	10	10	10	10	0	0	66.7	5.2
32	10	10	10	10	10	10	100.0	0.0
33	0	0	0	10	10	0	33.3	5.2
34	10	10	10	10	10	10	100.0	0.0
35	10	10	10	10	10	0	83.3	4.1
36	10	10	10	10	10	10	100.0	0.0
37	10	10	10	0	10	0	66.7	5.2

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
38	0	10	10	10	10	0	66.7	5.2
39	0	0	0	0	0	10	16.7	4.1
40	10	10	10	10	10	10	100.0	0.0
41	10	0	0	0	0	0	16.7	4.1
42	10	0	0	0	10	10	50.0	5.5
43	10	0	0	0	0	0	16.7	4.1
44	10	10	0	0	10	10	66.7	5.2
45	0	10	0	0	0	0	16.7	4.1
46	0	10	0	0	0	0	16.7	4.1
47	10	0	10	10	0	0	50.0	5.5
48	0	0	0	0	0	0	0.0	0.0
49	10	10	10	10	0	0	66.7	5.2
50	10	0	10	10	0	10	66.7	5.2
51	0	0	10	10	0	10	50.0	5.5
52	10	10	0	0	0	10	50.0	5.5
53	10	0	0	0	10	10	50.0	5.5
54	0	0	0	0	10	0	16.7	4.1
55	0	0	0	10	0	10	33.3	5.2
56	10	0	0	0	0	0	16.7	4.1
57	0	0	10	10	0	0	33.3	5.2
58	10	10	0	10	0	10	66.7	5.2
59	0	10	10	0	10	0	50.0	5.5
60	10	10	0	10	10	10	83.3	4.1
61	10	10	0	10	10	10	83.3	4.1
62	0	0	0	0	10	0	16.7	4.1
63	10	0	10	10	0	0	50.0	5.5
64	0	0	10	0	10	0	33.3	5.2
65	0	0	10	0	10	10	50.0	5.5
66	10	10	10	10	10	10	100.0	0.0
67	10	10	0	0	0	0	33.3	5.2
68	10	10	10	10	10	10	100.0	0.0
69	0	0	0	0	0	0	0.0	0.0
70	10	0	10	10	10	10	83.3	4.1
71	10	10	0	10	0	0	50.0	5.5
72	0	10	10	0	0	10	50.0	5.5
73	10	10	0	0	0	0	33.3	5.2
74	0	10	10	10	0	10	66.7	5.2
75	10	0	0	10	10	0	50.0	5.5
76	10	10	10	10	10	10	100.0	0.0
77	0	0	0	0	0	10	16.7	4.1
78	10	10	10	10	10	10	100.0	0.0
79	0	0	0	0	0	0	0.0	0.0

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
80	10	0	10	0	0	10	50.0	5.5
81	0	0	0	0	0	0	0.0	0.0
82	10	0	10	10	10	10	83.3	4.1
83	0	0	10	0	10	10	50.0	5.5
84	10	10	0	10	10	0	66.7	5.2
85	10	10	10	0	0	10	66.7	5.2
86	10	10	10	10	10	10	100.0	0.0
87	0	10	10	0	0	0	33.3	5.2
88	0	0	10	0	0	10	33.3	5.2
89	10	0	10	10	10	10	83.3	4.1
90	0	0	0	0	0	0	0.0	0.0
91	0	10	0	10	0	0	33.3	5.2
92	10	0	0	10	0	10	50.0	5.5
93	0	0	0	0	10	0	16.7	4.1
94	0	0	0	0	0	0	0.0	0.0
95	10	10	10	10	10	10	100.0	0.0
96	10	10	10	10	10	10	100.0	0.0
97	10	10	10	10	10	0	83.3	4.1
98	0	10	10	0	10	0	50.0	5.5
99	10	10	10	0	10	0	66.7	5.2
100	10	10	10	10	10	10	100.0	0.0
101	10	10	10	10	10	10	100.0	0.0
102	10	0	10	10	0	10	66.7	5.2
103	10	10	0	10	10	10	83.3	4.1
104	0	10	10	10	10	0	66.7	5.2
105	0	10	10	0	0	0	33.3	5.2
106	10	10	10	10	10	10	100.0	0.0
107	10	10	10	10	10	0	83.3	4.1
108	10	10	10	10	0	0	66.7	5.2
109	0	0	10	0	0	10	33.3	5.2
110	10	0	10	10	10	10	83.3	4.1
111	10	10	10	10	10	10	100.0	0.0
112	0	0	0	0	10	0	16.7	4.1
113	0	10	0	0	0	0	16.7	4.1
114	0	0	0	10	10	10	50.0	5.5
115	0	10	10	0	10	10	66.7	5.2
116	10	10	10	10	0	10	83.3	4.1
117	10	10	10	10	10	10	100.0	0.0
118	10	0	10	0	10	10	66.7	5.2
119	0	0	10	10	0	10	50.0	5.5
120	10	10	10	10	10	10	100.0	0.0
121	0	0	10	0	10	10	50.0	5.5

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
122	10	10	10	10	10	10	100.0	0.0
123	0	10	10	10	10	10	83.3	4.1
124	10	10	0	10	10	0	66.7	5.2
125	0	10	10	10	10	10	83.3	4.1
126	0	10	10	10	10	10	83.3	4.1
127	10	10	0	0	0	0	33.3	5.2
128	0	10	0	0	0	0	16.7	4.1
129	10	10	10	10	10	10	100.0	0.0
130	0	10	10	0	10	10	66.7	5.2
131	10	10	10	10	10	10	100.0	0.0
132	10	10	10	10	10	10	100.0	0.0
133	10	10	10	10	10	0	83.3	4.1
134	0	10	10	10	10	0	66.7	5.2
135	10	10	10	10	10	10	100.0	0.0
136	10	10	10	0	10	0	66.7	5.2
137	10	10	10	0	10	10	83.3	4.1
138	0	10	10	0	0	0	33.3	5.2
139	10	10	10	10	10	10	100.0	0.0
140	10	0	0	0	0	0	16.7	4.1
141	10	0	0	10	10	0	50.0	5.5
142	10	10	10	10	10	10	100.0	0.0
143	0	0	0	0	10	0	16.7	4.1
144	0	10	0	0	10	0	33.3	5.2
145	10	10	10	0	10	10	83.3	4.1
146	10	10	10	10	10	10	100.0	0.0
147	10	0	10	10	0	10	66.7	5.2
148	10	0	10	0	0	0	33.3	5.2
149	0	0	10	10	0	0	33.3	5.2
150	10	10	10	10	10	10	100.0	0.0
151	10	10	10	0	0	0	50.0	5.5
152	10	0	0	0	10	0	33.3	5.2
153	10	10	10	10	10	10	100.0	0.0
154	10	0	0	0	0	0	16.7	4.1
155	0	10	10	10	10	0	66.7	5.2
156	10	10	10	10	10	10	100.0	0.0
157	10	10	10	10	10	10	100.0	0.0
158	0	0	10	0	0	10	33.3	5.2
159	0	0	0	0	0	0	0.0	0.0
160	10	10	10	0	10	0	66.7	5.2
161	0	10	0	10	10	0	50.0	5.5
162	10	0	0	10	10	10	66.7	5.2
163	10	10	10	10	10	0	83.3	4.1

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
164	10	0	10	10	10	10	83.3	4.1
165	0	10	0	10	10	0	50.0	5.5
166	0	10	10	0	0	0	33.3	5.2
167	10	10	10	10	10	10	100.0	0.0
168	0	0	0	10	0	10	33.3	5.2
169	10	10	10	10	10	10	100.0	0.0
170	0	0	10	10	10	0	50.0	5.5
171	10	10	10	10	10	10	100.0	0.0
172	10	10	10	0	10	10	83.3	4.1
173	10	0	0	0	10	10	50.0	5.5
174	10	10	10	0	10	10	83.3	4.1
175	10	0	0	10	10	0	50.0	5.5
176	10	0	0	10	0	0	33.3	5.2
177	10	10	0	10	10	10	83.3	4.1
178	10	10	10	10	0	10	83.3	4.1
179	10	0	0	0	10	0	33.3	5.2
180	0	10	0	10	10	0	50.0	5.5
181	10	10	0	10	10	10	83.3	4.1
182	10	10	10	10	10	10	100.0	0.0
183	10	10	10	10	10	10	100.0	0.0
184	10	10	10	10	10	0	83.3	4.1
185	10	10	10	10	10	10	100.0	0.0
186	10	0	0	0	10	0	33.3	5.2
187	10	0	0	0	10	10	50.0	5.5
188	10	10	10	10	10	10	100.0	0.0
189	0	10	10	0	10	0	50.0	5.5
190	0	10	10	0	0	0	33.3	5.2
191	0	10	10	10	10	0	66.7	5.2
192	10	0	0	10	0	0	33.3	5.2
193	10	10	10	10	0	10	83.3	4.1
194	10	10	10	10	10	10	100.0	0.0
195	10	10	10	10	10	10	100.0	0.0
196	10	0	10	0	10	10	66.7	5.2
197	10	0	10	10	0	0	50.0	5.5
198	10	0	10	10	10	10	83.3	4.1
199	10	0	10	0	0	10	50.0	5.5
200	10	10	10	10	10	10	100.0	0.0
201	10	0	10	0	10	0	50.0	5.5
202	10	10	0	10	10	10	83.3	4.1
203	0	0	0	0	10	0	16.7	4.1
204	0	10	0	0	10	0	33.3	5.2
205	10	10	10	0	0	10	66.7	5.2

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
206	0	0	0	0	0	0	0.0	0.0
207	10	10	0	0	10	0	50.0	5.5
208	0	0	0	0	0	0	0.0	0.0
209	10	10	10	10	0	10	83.3	4.1
210	10	0	0	10	10	0	50.0	5.5
211	10	0	10	0	10	0	50.0	5.5
212	10	0	10	10	10	0	66.7	5.2
213	10	0	10	0	10	0	50.0	5.5
214	10	10	10	10	10	10	100.0	0.0
215	0	10	10	10	10	10	83.3	4.1
216	10	10	10	10	0	0	66.7	5.2
217	10	0	10	0	0	0	33.3	5.2
218	10	10	10	10	10	0	83.3	4.1
219	10	10	10	10	10	10	100.0	0.0
220	10	0	10	10	0	0	50.0	5.5
221	10	10	0	0	0	0	33.3	5.2
222	10	10	0	10	0	10	66.7	5.2
223	10	10	0	10	10	0	66.7	5.2
224	10	0	0	0	10	0	33.3	5.2
225	10	10	10	10	0	10	83.3	4.1
226	10	10	0	0	10	10	66.7	5.2
227	0	10	10	10	0	10	66.7	5.2
228	10	10	0	10	0	0	50.0	5.5
229	0	0	0	0	10	0	16.7	4.1
230	10	10	10	10	10	0	83.3	4.1
231	0	10	10	0	0	0	33.3	5.2
232	0	0	0	10	0	0	16.7	4.1
233	0	0	0	0	10	0	16.7	4.1
234	10	10	10	10	10	0	83.3	4.1
235	10	10	10	10	10	10	100.0	0.0
236	0	10	10	10	10	10	83.3	4.1
237	10	10	10	0	10	10	83.3	4.1
238	0	0	0	0	0	0	0.0	0.0
239	10	0	10	10	10	10	83.3	4.1
240	10	0	0	0	0	10	33.3	5.2
241	10	0	10	10	0	0	50.0	5.5
242	10	10	10	0	10	10	83.3	4.1
243	0	0	0	0	10	0	16.7	4.1
244	10	10	10	10	10	10	100.0	0.0
245	10	10	10	10	10	10	100.0	0.0
246	10	10	10	10	10	10	100.0	0.0
247	0	10	10	0	10	10	66.7	5.2

		Group I (MC items)						
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
248	10	10	10	0	10	0	66.7	5.2
249	10	10	10	0	10	0	66.7	5.2
250	10	10	10	10	0	0	66.7	5.2
251	10	10	10	10	10	10	100.0	0.0
252	10	10	0	10	0	0	50.0	5.5
253	10	10	10	10	10	10	100.0	0.0
254	10	10	10	10	10	10	100.0	0.0
255	10	10	10	10	10	10	100.0	0.0
256	10	10	10	10	0	10	83.3	4.1
257	0	10	10	0	0	0	33.3	5.2
258	0	10	10	10	10	0	66.7	5.2
259	10	10	10	10	10	10	100.0	0.0
260	10	10	10	10	10	10	100.0	0.0
261	0	10	10	0	10	0	50.0	5.5
262	10	10	10	10	0	10	83.3	4.1
263	10	10	10	10	0	10	83.3	4.1
264	10	10	10	10	10	0	83.3	4.1
265	0	10	10	10	0	0	50.0	5.5
266	10	0	10	10	10	10	83.3	4.1
267	10	0	10	0	10	10	66.7	5.2
268	10	10	0	0	10	10	66.7	5.2
269	10	10	0	0	0	0	33.3	5.2
270	0	10	10	10	10	10	83.3	4.1
271	0	10	10	10	10	10	83.3	4.1
272	0	10	10	0	10	10	66.7	5.2
273	10	10	10	10	10	10	100.0	0.0
274	10	10	10	0	10	10	83.3	4.1
275	10	10	10	10	10	10	100.0	0.0
276	10	10	10	10	10	10	100.0	0.0
277	10	10	10	10	10	10	100.0	0.0
278	10	10	10	10	10	0	83.3	4.1
279	0	0	10	0	0	0	16.7	4.1
280	10	10	10	10	10	10	100.0	0.0
281	10	10	10	10	10	10	100.0	0.0
282	10	10	10	10	10	0	83.3	4.1
283	10	10	10	10	10	10	100.0	0.0
284	10	10	10	10	10	10	100.0	0.0
285	0	0	10	10	10	10	66.7	5.2
286	10	10	10	10	10	10	100.0	0.0
287	10	10	10	10	10	10	100.0	0.0
288	10	10	10	10	10	10	100.0	0.0
289	0	0	0	10	0	0	16.7	4.1

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
290	10	10	10	10	10	0	83.3	4.1
291	0	0	10	10	10	0	50.0	5.5
292	10	0	10	10	10	10	83.3	4.1
293	0	0	0	10	10	0	33.3	5.2
294	0	0	0	0	10	0	16.7	4.1
295	0	0	0	10	0	0	16.7	4.1
296	0	0	0	0	10	0	16.7	4.1
297	0	10	0	10	0	10	50.0	5.5
298	10	0	0	0	10	0	33.3	5.2
299	10	0	10	10	10	10	83.3	4.1
300	0	0	10	0	10	0	33.3	5.2
301	0	10	0	0	10	0	33.3	5.2
302	10	10	10	0	10	0	66.7	5.2
303	0	10	0	10	0	0	33.3	5.2
304	10	10	0	0	0	0	33.3	5.2
305	0	0	10	10	0	0	33.3	5.2
306	10	10	10	0	10	0	66.7	5.2
307	0	10	0	0	10	10	50.0	5.5
308	10	0	10	10	0	10	66.7	5.2
309	0	10	10	0	10	10	66.7	5.2
310	10	10	0	0	0	0	33.3	5.2
311	0	10	0	0	10	0	33.3	5.2
312	10	0	10	0	0	0	33.3	5.2
313	10	10	10	10	0	10	83.3	4.1
314	10	10	10	10	10	10	100.0	0.0
315	10	0	10	0	10	0	50.0	5.5
316	10	10	10	0	10	10	83.3	4.1
317	0	10	10	10	10	10	83.3	4.1
318	0	0	0	0	0	0	0.0	0.0
319	10	10	10	10	10	10	100.0	0.0
320	10	10	0	0	0	10	50.0	5.5
321	0	10	0	10	0	0	33.3	5.2
322	0	0	10	0	0	0	16.7	4.1
323	0	0	10	10	10	0	50.0	5.5
324	10	10	0	0	10	0	50.0	5.5
325	10	0	10	10	10	10	83.3	4.1
326	10	10	10	0	0	10	66.7	5.2
327	0	10	0	0	10	0	33.3	5.2
328	10	10	0	10	0	0	50.0	5.5
329	10	10	10	10	10	10	100.0	0.0
330	10	10	0	10	10	0	66.7	5.2
331	10	0	0	0	0	0	16.7	4.1

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
332	0	10	0	0	0	0	16.7	4.1
333	10	0	10	10	10	10	83.3	4.1
334	0	10	0	0	10	0	33.3	5.2
335	0	10	0	10	10	10	66.7	5.2
336	0	0	10	10	0	0	33.3	5.2
337	10	10	0	0	10	10	66.7	5.2
338	0	0	10	0	0	10	33.3	5.2
339	10	10	10	0	10	10	83.3	4.1
340	10	10	10	10	10	10	100.0	0.0
341	10	10	10	0	10	10	83.3	4.1
342	10	10	10	10	10	10	100.0	0.0
343	0	0	10	10	0	0	33.3	5.2
344	10	10	10	10	10	10	100.0	0.0
345	0	0	10	0	10	0	33.3	5.2
346	0	0	10	10	10	0	50.0	5.5
347	0	0	0	0	0	0	0.0	0.0
348	0	0	0	0	0	0	0.0	0.0
349	10	10	10	10	10	10	100.0	0.0
350	10	10	0	0	10	10	66.7	5.2
351	0	0	10	10	0	10	50.0	5.5
352	10	10	10	0	0	0	50.0	5.5
353	10	10	0	0	0	0	33.3	5.2
354	10	10	0	10	10	0	66.7	5.2
355	0	0	10	0	0	0	16.7	4.1
356	10	10	0	10	10	10	83.3	4.1
357	10	0	10	10	10	10	83.3	4.1
358	10	10	10	0	10	10	83.3	4.1
359	0	10	0	0	10	10	50.0	5.5
360	0	0	0	10	10	10	50.0	5.5
361	10	10	0	0	0	0	33.3	5.2
362	0	10	0	0	10	0	33.3	5.2
363	0	10	10	10	0	0	50.0	5.5
364	0	0	0	0	10	10	33.3	5.2
365	0	10	0	10	10	0	50.0	5.5
366	0	0	10	10	0	10	50.0	5.5
367	10	10	10	10	10	10	100.0	0.0
368	10	10	0	0	0	0	33.3	5.2
369	10	10	10	10	10	0	83.3	4.1
370	10	10	10	10	10	10	100.0	0.0
371	10	10	10	10	0	0	66.7	5.2
372	0	10	10	0	0	0	33.3	5.2
373	10	10	0	0	10	0	50.0	5.5

	Group I (MC items)							
Student	1(10)	2(10)	3(10)	4(10)	5(10)	6(10)	Means st	SD st
374	10	10	10	0	10	10	83.3	4.1
375	10	10	10	0	0	10	66.7	5.2
376	0	0	10	10	10	0	50.0	5.5
377	10	10	10	10	10	10	100.0	0.0
378	0	10	10	10	10	0	66.7	5.2
379	10	0	0	0	0	0	16.7	4.1
380	0	10	0	0	0	0	16.7	4.1
381	10	10	10	10	10	0	83.3	4.1
382	10	10	10	10	10	0	83.3	4.1
Means item	64.4	64.7	65.4	58.9	64.9	51.6	61.6	0.1
SD item	4.8	4.8	4.8	4.9	4.8	5.0		

Table 6.59. Data of 382 examinees grades in Group II (CR items), Chemistry Exam 1st Phase, 2005.

	Group II (CR items)																		
Student	1.1(5)	1.2(4)	1.3(())	1.4(7)	2.1(4)	2.2.1(())	2.2.2(())	2.3(())	3.1(6)	3.2(6)	3.3(7)	3.4(7)	3.5(4)	4.1(7)	4.2.1(6)	4.2.1(9)	4.3(6)	Means st	SD st
1	5	4	7	7	4	8	8	8	6	4	7	7	4	7	6	8	6	106.0	1.5
2	3	4	8	0	4	8	0	8	6	5	0	0	0	6	9	0	0	61.0	3.5
3	5	4	0	3	4	7	8	5	6	6	0	0	0	7	6	9	6	76.0	2.9
4	5	4	0	0	0	8	8	8	6	6	0	0	4	0	6	0	6	61.0	3.3
5	5	4	8	7	4	8	8	8	6	6	7	7	4	7	6	6	6	107.0	1.4
6	5	4	1	3	4	8	0	0	6	6	0	0	0	0	6	6	6	55.0	2.9
7	5	4	8	7	4	8	8	8	6	6	7	7	4	7	6	9	6	110.0	1.5
8	5	4	8	7	4	8	0	8	6	6	0	2	0	7	6	8	0	79.0	3.1
9	5	0	3	3	4	8	0	8	6	6	0	0	0	0	6	2	6	57.0	3.0
10	5	8	0	4	8	0	8	5	6	0	0	0	0	0	6	7	6	63.0	3.4
11	3	4	8	4	7	8	8	6	6	7	4	0	0	0	6	9	0	80.0	3.2
12	5	4	3	7	4	8	8	6	6	7	7	0	0	0	6	7	0	78.0	3.0
13	5	4	0	7	0	0	8	0	1	6	6	0	0	0	0	8	6	51.0	3.3
14	5	4	8	7	4	8	8	8	6	6	7	7	4	7	6	9	6	110.0	1.5
15	5	0	0	0	4	8	5	0	0	6	6	0	0	7	6	6	6	59.0	3.1
16	5	8	4	0	4	8	0	3	6	6	0	0	0	0	6	8	0	58.0	3.2
17	5	4	8	7	4	8	8	8	6	6	7	7	4	7	6	9	6	110.0	1.5
18	5	4	8	7	4	8	8	8	6	6	7	7	4	7	6	9	6	110.0	1.5
19	3	6	0	8	5	0	0	0	0	0	0	0	0	0	0	7	6	35.0	3.0
20	5	3	0	4	8	8	8	6	6	7	4	7	6	0	6	9	6	93.0	2.6
21	5	4	0	0	8	0	3	6	6	0	0	0	0	0	6	7	0	45.0	3.1
22	5	0	8	7	4	8	8	8	6	6	7	4	2	7	6	8	0	94.0	2.7
23	5	0	8	3	4	8	0	8	6	6	7	0	2	0	6	9	6	78.0	3.2
24	3	0	0	8	3	6	7	0	6	6	0	0	0	0	0	8	0	47.0	3.3
25	5	4	1	7	4	8	8	8	6	6	7	7	4	7	6	9	6	103.0	2.0
26	5	0	0	0	8	8	8	6	2	0	0	5	0	6	6	0	0	54.0	3.4
27	5	4	8	3	4	8	8	6	6	7	7	7	4	6	9	6	0	98.0	2.3
28	5	4	8	3	4	0	0	0	0	2	0	0	0	0	6	5	6	43.0	2.8

Group II (CR items)																			
Student	1.1(5)	1.2(4)	1.3(())	1.4(7)	2.1(4)	2.2.1(())	2.2.2(())	2.3(())	3.1(6)	3.2(6)	3.3(7)	3.4(7)	3.5(4)	4.1(7)	4.2.1(6)	4.2.1(9)	4.3(6)	Means st	SD st
29	5	4	8	0	4	8	8	3	6	6	7	4	0	0	6	9	6	84.0	2.9
30	5	0	0	3	4	8	8	8	5	6	0	0	0	0	0	7	6	60.0	3.3
31	3	0	8	0	4	8	0	5	6	6	7	0	0	0	6	7	6	66.0	3.2
32	5	4	8	7	4	8	8	5	6	6	7	5	4	0	6	9	0	92.0	2.6
33	5	0	0	0	8	0	8	6	4	0	0	7	0	0	6	9	0	53.0	3.6
34	5	8	7	4	8	8	8	6	6	7	5	3	4	6	6	9	6	106.0	1.7
35	5	4	8	7	4	8	8	8	6	7	0	0	2	7	6	7	6	93.0	2.6
36	5	4	8	3	4	8	8	5	6	6	7	0	2	7	5	4	6	88.0	2.2
37	5	4	3	3	4	8	0	8	6	0	7	3	2	7	6	2	6	74.0	2.5
38	0	0	0	0	4	8	0	8	0	0	0	0	0	7	6	4	6	43.0	3.3
39	5	0	0	0	4	8	5	5	0	0	0	0	0	7	6	0	6	46.0	3.1
40	5	4	8	0	4	8	8	8	6	6	7	7	0	7	6	9	6	99.0	2.6
41	5	0	8	0	4	8	3	6	7	0	4	0	0	6	4	6	3	64.0	2.9
42	0	0	3	0	4	0	0	5	5	0	0	0	0	7	6	4	6	40.0	2.7
43	5	0	0	0	0	8	0	5	4	5	0	0	0	7	6	7	6	53.0	3.2
44	5	4	8	0	4	2	8	5	6	2	0	7	0	0	0	0	0	51.0	3.1
45	0	0	8	0	4	8	0	3	6	0	0	0	0	7	6	7	0	49.0	3.4
46	0	4	2	0	4	8	0	3	0	0	0	0	0	0	6	5	0	32.0	2.6
47	5	0	8	7	4	8	7	3	6	6	7	7	0	0	5	4	6	83.0	2.7
48	5	4	1	0	0	2	0	8	0	0	0	3	0	0	6	0	0	29.0	2.6
49	5	4	8	3	4	8	0	0	6	6	0	0	0	0	0	5	0	49.0	3.1
50	5	4	3	7	4	8	8	3	0	6	0	3	2	6	6	0	0	65.0	2.8
51	5	4	8	0	4	6	8	3	6	6	7	5	2	0	6	9	0	79.0	2.8
52	5	4	2	0	4	8	8	0	4	0	0	2	0	5	4	0	6	52.0	2.8
53	5	4	8	7	4	7	0	8	0	0	0	0	0	0	5	4	0	52.0	3.2
54	5	4	0	3	0	2	0	5	5	3	0	0	0	0	5	0	0	32.0	2.2
55	3	4	5	0	0	0	0	3	4	0	0	0	0	7	0	4	0	30.0	2.3
56	5	0	8	0	4	8	8	8	0	6	0	0	0	0	6	2	6	61.0	3.4
57	3	0	0	0	4	7	0	5	0	2	0	0	0	0	6	8	6	41.0	3.0
58	0	4	3	0	4	0	0	3	6	6	0	0	0	0	5	9	6	46.0	3.0

Group II (CR items)																			
Student	1.1(5)	1.2(4)	1.3(())	1.4(7)	2.1(4)	2.2.1(())	2.2.2(())	2.3(())	3.1(6)	3.2(6)	3.3(7)	3.4(7)	3.5(4)	4.1(7)	4.2.1(6)	4.2.1(9)	4.3(6)	Means st	SD st
59	5	4	0	7	4	0	0	0	4	5	0	0	0	0	5	4	6	44.0	2.6
60	5	4	0	0	4	2	8	0	5	4	0	5	0	7	0	8	0	52.0	3.0
61	5	4	0	3	4	2	0	8	6	6	0	5	0	0	6	7	0	56.0	2.9
62	3	0	1	0	4	0	0	5	0	0	0	0	0	0	0	0	0	13.0	1.6
63	0	4	0	0	0	0	0	5	0	0	0	0	0	0	0	6	0	15.0	2.0
64	0	0	0	0	0	2	0	3	6	2	0	0	0	0	6	7	6	32.0	2.7
65	5	0	6	7	4	8	8	3	0	0	0	0	0	0	5	7	6	59.0	3.2
66	5	4	8	3	4	8	8	5	6	6	7	3	4	0	6	9	6	92.0	2.3
67	5	4	8	7	4	8	8	1	0	0	0	0	0	0	5	7	6	63.0	3.3
68	5	4	8	0	4	8	8	0	5	6	0	0	0	0	6	7	6	67.0	3.2
69	5	0	0	0	0	2	0	8	6	2	0	0	0	0	0	6	6	35.0	2.9
70	5	4	8	4	4	8	8	3	6	6	0	0	0	0	6	7	6	75.0	2.9
71	5	4	8	0	4	8	0	8	6	4	7	0	0	0	6	4	0	64.0	3.2
72	5	4	8	7	4	8	8	8	6	6	7	2	0	7	6	7	0	93.0	2.6
73	3	4	0	0	0	0	0	0	0	6	0	2	0	0	5	0	0	20.0	2.0
74	4	0	0	0	4	8	8	8	6	6	7	0	0	7	0	6	0	64.0	3.4
75	3	4	5	0	4	1	0	0	0	0	7	0	0	0	5	4	6	39.0	2.5
76	5	4	8	7	4	8	8	8	6	6	7	7	4	7	6	9	6	110.0	1.5
77	5	4	3	0	4	1	0	0	0	0	0	0	0	0	6	0	0	23.0	2.1
78	5	4	8	7	4	8	8	8	6	6	7	5	4	7	6	7	6	106.0	1.4
79	3	0	1	0	0	2	5	3	0	0	0	0	0	0	6	0	0	20.0	1.9
80	5	4	3	0	4	8	8	5	6	6	7	2	4	0	6	6	0	74.0	2.6
81	5	0	3	0	4	2	0	3	0	0	0	0	0	7	6	2	0	32.0	2.4
82	5	4	8	7	4	8	8	8	5	4	7	2	0	0	0	4	6	80.0	2.9
83	0	4	3	3	4	8	8	8	2	0	0	0	0	0	5	6	6	57.0	3.1
84	5	4	3	0	4	2	0	8	0	6	7	0	0	0	6	4	6	55.0	2.8
85	1	4	3	0	0	8	8	8	0	0	0	0	0	0	0	0	0	32.0	3.1
86	5	4	1	3	4	2	0	8	0	6	7	5	0	7	6	4	6	68.0	2.6
87	5	4	8	0	0	2	0	0	0	4	0	0	0	7	6	2	6	44.0	2.9
88	3	0	0	0	0	2	0	5	0	0	0	0	0	7	4	0	0	21.0	2.2

Group II (CR items)																			
Student	1.1(5)	1.2(4)	1.3(())	1.4(7)	2.1(4)	2.2.1(())	2.2.2(())	2.3(())	3.1(6)	3.2(6)	3.3(7)	3.4(7)	3.5(4)	4.1(7)	4.2.1(6)	4.2.1(9)	4.3(6)	Means st	SD st
89	5	4	8	7	4	8	8	8	6	6	7	5	4	7	6	9	0	102.0	2.2
90	0	0	1	0	4	8	8	3	0	0	0	0	0	7	6	2	0	39.0	3.1
91	0	4	1	0	4	0	0	8	0	0	0	0	0	0	6	4	0	27.0	2.6
92	3	4	0	0	4	8	0	3	6	5	0	0	0	0	6	0	0	39.0	2.8
93	0	0	1	0	4	8	0	3	5	6	0	0	2	0	6	7	0	42.0	2.9
94	5	4	0	0	0	0	0	3	0	0	0	0	0	0	6	2	6	26.0	2.3
95	5	4	7	7	4	8	8	8	6	4	7	7	0	0	6	6	6	93.0	2.5
96	5	4	8	3	0	8	0	8	6	6	7	7	0	0	6	6	6	80.0	3.0
97	5	4	0	3	4	7	8	8	6	2	0	0	0	7	6	2	0	62.0	3.0
98	5	4	1	0	4	8	7	8	6	6	0	0	0	7	6	9	0	71.0	3.3
99	0	0	8	7	4	8	8	8	5	2	7	0	0	0	4	7	0	68.0	3.5
100	5	4	7	7	0	8	5	8	6	6	0	0	0	7	5	8	6	82.0	3.0
101	5	0	0	0	4	8	8	8	0	6	7	0	0	0	5	7	6	64.0	3.4
102	5	0	5	0	4	8	8	3	0	0	0	0	0	0	6	7	6	52.0	3.2
103	5	4	8	7	4	8	8	8	6	6	7	0	0	7	6	9	6	99.0	2.6
104	5	4	7	3	4	6	8	8	0	6	0	0	0	7	6	9	6	79.0	3.1
105	5	4	0	0	4	8	8	8	0	2	0	0	0	0	6	4	6	55.0	3.2
106	4	4	1	4	4	2	0	8	6	5	0	0	0	7	6	4	6	61.0	2.6
107	5	4	8	7	4	8	8	5	6	2	0	0	0	7	5	9	6	84.0	2.9
108	1	0	0	0	4	8	0	3	6	2	0	0	0	0	0	4	0	28.0	2.5
109	5	0	5	0	4	8	0	3	0	2	0	0	0	0	6	3	6	42.0	2.7
110	5	4	8	7	4	8	8	8	6	0	0	6	7	0	6	8	6	91.0	2.9
111	5	4	1	7	4	8	8	8	6	6	0	0	4	7	6	7	6	87.0	2.6
112	0	0	1	0	4	8	0	3	0	0	0	0	0	0	0	6	0	22.0	2.5
113	5	4	7	0	4	0	0	8	0	6	0	4	4	0	0	0	0	42.0	2.9
114	5	0	3	0	0	8	8	5	0	0	0	0	0	0	5	4	0	38.0	3.0
115	5	0	0	0	4	8	0	8	0	0	0	0	0	0	6	5	0	36.0	3.1
116	5	4	8	0	4	8	0	8	0	0	0	3	0	0	6	5	0	51.0	3.2
117	5	4	7	0	4	8	8	3	6	4	0	4	0	6	9	6	0	74.0	3.0
118	5	0	0	0	4	2	0	3	4	0	0	0	0	0	6	9	6	39.0	2.9

Group II (CR items)																			
Student	1.1(5)	1.2(4)	1.3(())	1.4(7)	2.1(4)	2.2.1(())	2.2.2(())	2.3(())	3.1(6)	3.2(6)	3.3(7)	3.4(7)	3.5(4)	4.1(7)	4.2.1(6)	4.2.1(9)	4.3(6)	Means st	SD st
119	5	4	8	7	4	8	8	5	6	6	7	0	0	0	5	7	0	80.0	3.0
120	5	4	8	7	4	8	8	8	6	5	0	2	0	7	6	6	6	90.0	2.6
121	5	4	7	7	4	8	0	8	5	0	0	0	0	0	6	7	6	67.0	3.2
122	5	4	1	7	4	8	8	8	6	2	7	4	0	0	6	9	6	85.0	2.9
123	5	4	8	7	4	8	8	8	6	7	7	1	0	7	6	8	0	94.0	2.8
124	5	4	8	7	4	8	5	5	6	0	0	0	0	0	6	9	0	67.0	3.3
125	5	4	8	7	4	8	8	8	5	2	7	4	4	7	6	9	6	102.0	2.0
126	5	4	8	3	4	8	7	8	4	6	0	0	0	0	0	0	0	57.0	3.2
127	5	4	1	3	4	4	8	5	0	0	0	0	0	0	5	4	0	43.0	2.6
128	3	0	1	0	0	0	0	8	5	6	0	0	0	0	6	9	0	38.0	3.2
129	5	4	8	7	4	8	8	8	6	4	0	5	4	7	6	9	6	99.0	2.2
130	3	4	8	0	4	6	0	8	6	2	0	2	0	0	6	7	6	62.0	3.0
131	5	4	0	0	4	8	3	8	0	5	0	0	0	4	0	0	0	41.0	2.9
132	5	4	8	7	4	8	8	8	6	6	7	6	4	7	6	9	6	109.0	1.5
133	5	4	5	3	4	8	8	8	6	6	7	3	0	7	6	9	6	95.0	2.3
134	5	0	0	0	4	2	0	5	6	6	0	4	0	0	6	6	6	50.0	2.7
135	5	4	8	7	4	8	0	5	0	6	7	0	0	7	6	7	6	80.0	2.9
136	5	4	3	7	0	8	7	5	6	6	7	0	2	0	6	7	6	79.0	2.7
137	5	4	8	7	4	0	0	3	6	6	7	0	4	0	6	9	6	75.0	2.9
138	4	4	1	0	0	8	0	0	6	2	7	0	0	7	6	4	6	55.0	3.0
139	5	4	8	7	4	8	8	8	6	6	7	7	4	7	6	9	6	110.0	1.5
140	5	4	8	3	4	2	0	8	6	0	7	0	0	7	6	9	6	75.0	3.1
141	5	4	0	0	0	8	8	5	6	6	7	0	2	0	6	8	6	71.0	3.1
142	5	4	8	7	4	8	8	8	6	6	7	7	4	7	6	9	6	110.0	1.5
143	5	4	1	3	4	8	0	5	0	0	0	0	0	0	6	0	0	36.0	2.7
144	5	4	8	0	0	0	0	8	0	2	0	0	0	0	6	0	6	39.0	3.1
145	5	0	1	7	4	8	8	8	6	6	7	0	2	0	6	7	6	81.0	3.0
146	5	4	8	0	4	8	5	8	0	2	7	0	0	0	5	7	6	69.0	3.1
147	5	4	1	3	4	8	0	8	0	2	0	0	0	0	6	2	6	49.0	2.9
148	5	4	8	0	4	8	8	5	6	2	0	0	0	0	5	2	0	57.0	3.1

Group II (CR items)																			
Student	1.1(5)	1.2(4)	1.3(())	1.4(7)	2.1(4)	2.2.1(())	2.2.2(())	2.3(())	3.1(6)	3.2(6)	3.3(7)	3.4(7)	3.5(4)	4.1(7)	4.2.1(6)	4.2.1(9)	4.3(6)	Means st	SD st
149	5	4	8	7	4	8	0	8	0	0	0	0	0	0	0	2	0	46.0	3.3
150	5	4	3	7	4	8	0	8	6	6	7	7	2	0	6	9	6	88.0	2.7
151	3	4	8	7	4	8	0	1	5	0	0	0	0	0	6	4	6	56.0	3.0
152	1	0	0	0	4	0	0	8	0	0	0	0	0	0	0	0	6	19.0	2.4
153	5	4	0	7	4	8	0	5	0	6	0	0	0	0	6	0	0	45.0	3.0
154	5	4	5	7	4	0	8	8	0	0	0	0	0	0	6	7	6	60.0	3.2
155	5	4	3	7	4	5	0	0	6	2	0	0	0	7	6	7	6	62.0	2.8
156	5	4	8	7	4	8	8	5	5	0	0	0	0	0	6	4	6	70.0	3.0
157	5	4	3	7	4	8	8	5	6	6	7	4	2	7	6	8	0	90.0	2.3
158	5	4	7	4	4	8	8	5	6	6	7	0	0	0	6	0	6	76.0	2.8
159	5	0	1	0	4	8	7	5	0	0	0	0	0	0	6	0	0	36.0	3.0
160	5	4	8	7	4	8	0	5	6	2	0	0	0	0	6	7	6	68.0	3.0
161	5	0	2	3	4	8	8	8	0	0	0	0	0	0	0	8	6	52.0	3.4
162	5	0	3	3	4	0	0	8	0	0	0	0	0	0	5	0	0	28.0	2.5
163	3	4	8	7	4	8	5	8	0	2	0	0	0	7	6	4	6	72.0	3.0
164	5	0	2	7	4	8	8	8	0	6	6	7	4	7	6	9	6	93.0	2.7
165	5	4	8	0	4	0	0	8	6	6	7	0	4	0	6	9	6	73.0	3.2
166	5	4	7	0	4	8	8	5	0	0	0	0	0	0	6	9	6	62.0	3.4
167	5	4	8	0	4	8	8	8	6	0	7	7	0	7	6	7	6	91.0	2.8
168	2	4	0	0	4	8	0	1	0	0	0	0	0	0	6	2	0	27.0	2.5
169	5	4	0	7	0	8	0	5	6	6	3	0	0	7	6	7	6	70.0	3.0
170	5	4	8	3	4	5	0	8	5	0	0	0	0	0	6	4	0	52.0	2.9
171	5	4	8	7	4	8	8	8	5	6	7	0	4	7	6	9	6	102.0	2.2
172	5	4	5	0	4	8	8	8	0	4	0	0	0	0	6	7	6	65.0	3.2
173	5	4	0	7	0	4	0	3	5	6	0	0	0	0	6	9	6	55.0	3.1
174	5	0	1	7	4	7	0	0	0	3	0	0	0	7	0	2	0	36.0	2.8
175	5	4	8	0	0	8	8	8	6	6	7	4	0	7	6	6	6	89.0	2.8
176	5	0	8	4	4	8	8	3	0	4	0	0	0	7	6	7	6	70.0	3.1
177	5	4	8	7	4	8	8	8	6	6	7	4	0	0	6	7	6	94.0	2.5
178	5	4	8	7	4	8	8	8	6	4	7	0	0	7	6	4	6	92.0	2.5

								Group II (CR items)										
Student	1.1(5)	1.2(4)	1.3(())	1.4(7)	2.1(4)	2.2.1(())	2.2.2(())	2.3(())	3.1(6)	3.2(6)	3.3(7)	3.4(7)	3.5(4)	4.1(7)	4.2.1(6)	4.2.1(9)	4.3(6)	Means st	SD st
179	5	0	0	0	0	8	0	1	5	4	0	2	0	7	6	7	0	45.0	3.1
180	5	4	8	0	4	2	0	8	6	4	7	4	0	7	6	7	0	72.0	2.9
181	5	4	8	7	4	8	8	8	5	6	7	0	0	7	6	4	6	93.0	2.5
182	5	4	0	7	4	8	0	8	6	4	7	0	0	0	6	4	6	69.0	3.0
183	5	4	8	7	4	8	8	8	6	6	0	7	2	7	6	9	0	95.0	2.8
184	5	4	8	7	4	8	8	8	6	6	7	0	2	0	6	9	6	94.0	2.7
185	5	4	7	7	4	8	8	8	5	6	7	3	2	7	6	6	6	99.0	1.8
186	5	4	8	0	0	8	5	8	5	6	0	0	2	0	6	4	6	67.0	3.0
187	5	4	8	3	4	8	3	5	2	0	0	0	0	0	6	4	6	58.0	2.8
188	5	4	8	7	4	8	5	8	6	6	7	7	4	0	6	7	0	92.0	2.5
189	5	4	8	3	0	0	5	3	6	6	0	0	2	0	0	9	0	51.0	3.1
190	5	4	8	3	4	0	0	0	0	0	0	0	0	0	6	7	0	37.0	2.9
191	5	4	8	7	4	8	8	8	5	6	7	0	0	0	6	7	6	89.0	2.8
192	5	4	3	7	4	8	0	8	0	6	7	0	0	0	6	8	6	72.0	3.2
193	5	4	8	3	4	8	8	3	6	6	0	7	4	7	6	4	6	89.0	2.2
194	5	4	8	3	4	8	8	8	6	6	7	7	2	0	6	4	6	92.0	2.3
195	5	4	8	7	4	8	8	8	6	6	0	0	2	0	6	8	6	86.0	2.9
196	5	0	8	7	4	8	8	0	0	6	0	2	0	0	6	4	6	64.0	3.3
197	5	4	7	7	0	7	7	8	6	6	3	0	0	0	6	7	6	79.0	2.9
198	5	0	2	7	4	8	0	1	6	0	0	0	0	7	6	6	0	52.0	3.1
199	5	4	1	7	4	8	8	8	6	0	0	0	0	7	6	9	6	79.0	3.3
200	5	4	8	7	4	8	8	8	6	6	7	7	4	7	6	9	6	110.0	1.5
201	5	0	0	0	0	8	8	8	0	6	0	0	0	0	6	4	6	51.0	3.4
202	5	4	8	7	4	8	8	8	6	6	7	7	4	7	6	8	6	109.0	1.5
203	5	4	5	0	4	8	2	3	6	4	0	4	0	7	6	3	6	67.0	2.4
204	3	4	1	0	4	0	0	3	6	4	7	0	0	7	6	4	6	55.0	2.6
205	5	4	0	7	0	8	7	3	6	4	7	0	0	0	6	7	6	70.0	3.0
206	5	0	2	0	0	2	0	8	0	6	0	0	0	7	6	4	0	40.0	3.0
207	5	4	8	3	4	8	8	0	6	6	7	0	0	0	6	6	0	71.0	3.1
208	5	4	8	0	4	8	8	1	6	6	0	0	0	0	5	7	6	68.0	3.2

Group II (CR items)																			
Student	1.1(5)	1.2(4)	1.3(())	1.4(7)	2.1(4)	2.2.1(())	2.2.2(())	2.3(())	3.1(6)	3.2(6)	3.3(7)	3.4(7)	3.5(4)	4.1(7)	4.2.1(6)	4.2.1(9)	4.3(6)	Means st	SD st
209	5	4	8	3	4	8	8	8	6	0	0	0	0	7	6	7	6	80.0	3.1
210	3	0	7	0	0	0	8	6	0	0	2	0	0	0	6	4	0	36.0	2.9
211	5	4	3	0	4	0	0	1	0	0	0	0	0	0	6	0	0	23.0	2.1
212	5	4	7	3	4	8	0	5	0	4	0	0	0	0	2	0	0	42.0	2.7
213	5	0	1	0	4	8	8	8	5	6	0	0	0	0	6	7	6	64.0	3.3
214	5	4	8	7	4	8	8	8	5	4	0	7	0	7	0	0	0	75.0	3.3
215	5	4	8	7	4	8	0	3	6	4	0	0	0	6	0	9	0	64.0	3.3
216	5	4	8	3	4	8	3	8	6	4	0	0	0	7	6	7	0	73.0	3.0
217	5	4	8	4	4	8	0	3	0	4	0	0	0	0	6	4	0	50.0	2.9
218	5	4	8	7	4	8	8	8	6	6	7	2	4	7	6	9	6	105.0	1.9
219	5	4	8	7	4	8	8	3	6	4	7	6	4	7	6	9	6	102.0	1.8
220	5	4	8	7	0	8	0	8	6	3	7	2	0	0	6	4	0	68.0	3.2
221	5	4	3	0	4	4	0	5	0	3	7	0	0	0	5	4	6	50.0	2.4
222	5	4	8	0	0	8	8	8	6	2	7	0	4	0	5	7	0	72.0	3.3
223	5	4	8	7	4	8	8	3	6	4	7	7	4	0	6	8	0	89.0	2.6
224	5	4	8	0	4	8	8	8	6	0	4	0	0	0	6	4	6	71.0	3.1
225	5	4	7	3	4	8	5	8	5	6	0	7	4	7	6	7	6	92.0	2.0
226	5	4	8	3	0	8	8	5	0	6	0	7	6	4	6	0	0	70.0	3.1
227	5	4	8	3	4	8	8	8	6	6	7	0	4	0	6	7	6	90.0	2.5
228	5	4	3	7	4	8	0	5	5	4	0	5	0	0	6	5	0	61.0	2.6
229	0	0	3	0	0	8	0	0	5	0	0	0	0	0	5	7	6	34.0	3.0
230	5	4	8	7	0	8	8	8	6	6	0	2	0	7	0	6	6	81.0	3.1
231	5	0	8	4	4	8	8	8	0	6	0	0	0	0	5	2	6	64.0	3.3
232	5	4	0	4	0	0	8	8	5	0	0	0	0	0	0	0	6	40.0	3.1
233	5	4	5	4	4	0	0	3	0	0	7	0	0	7	6	2	0	47.0	2.7
234	5	4	8	0	4	8	8	5	6	0	7	0	0	0	6	6	6	73.0	3.1
235	5	4	8	7	4	8	8	8	6	6	7	7	2	7	6	9	6	108.0	1.8
236	5	4	8	7	4	8	8	8	6	5	7	7	4	7	6	9	6	109.0	1.6
237	5	0	8	7	4	8	5	8	6	2	7	0	0	0	5	7	6	78.0	3.0
238	5	4	3	7	4	8	8	5	6	4	0	2	0	0	6	9	0	71.0	3.0

Group II (CR items)																			
Student	1.1(5)	1.2(4)	1.3(())	1.4(7)	2.1(4)	2.2.1(())	2.2.2(())	2.3(())	3.1(6)	3.2(6)	3.3(7)	3.4(7)	3.5(4)	4.1(7)	4.2.1(6)	4.2.1(9)	4.3(6)	Means st	SD st
239	5	0	0	3	4	7	0	3	0	2	0	0	0	0	6	5	6	41.0	2.6
240	5	4	3	0	4	8	0	5	6	6	0	0	0	0	5	7	0	53.0	2.9
241	5	0	3	0	4	2	0	5	6	4	7	5	0	0	6	6	0	53.0	2.6
242	5	4	8	3	4	8	8	8	6	6	7	5	0	0	4	4	0	80.0	2.8
243	5	0	8	3	4	2	0	3	5	2	0	0	0	0	5	0	0	37.0	2.5
244	5	4	8	7	4	8	8	8	6	6	7	7	4	7	6	9	6	110.0	1.5
245	5	4	8	3	4	8	0	5	0	0	0	0	0	7	6	7	6	63.0	3.1
246	5	4	8	7	4	8	8	8	6	4	7	4	0	7	6	9	6	101.0	2.2
247	5	4	3	7	4	8	8	1	0	6	7	4	0	0	6	6	0	69.0	2.9
248	5	4	8	7	0	8	8	5	6	6	7	7	4	7	6	9	6	103.0	2.1
249	5	4	8	3	4	8	0	8	6	2	0	4	0	7	6	7	6	78.0	2.8
250	3	4	3	7	4	2	8	5	0	0	0	0	0	0	0	0	0	36.0	2.7
251	5	4	8	7	4	8	8	8	6	5	0	7	0	0	6	7	6	89.0	2.8
252	5	4	3	7	4	2	0	8	0	0	0	0	0	7	0	3	0	43.0	2.9
253	5	4	8	7	4	8	8	8	4	4	7	7	0	7	6	9	6	102.0	2.3
254	5	4	8	7	0	8	8	8	6	6	7	4	0	0	6	9	6	92.0	2.9
255	5	4	8	7	4	4	8	8	6	6	7	4	7	7	6	9	6	106.0	1.6
256	5	4	8	7	4	8	8	5	6	6	7	0	0	0	6	7	6	87.0	2.7
257	5	0	0	7	4	8	0	3	6	6	0	0	0	0	6	2	6	53.0	3.0
258	5	4	8	0	0	4	8	0	6	0	7	0	0	0	6	0	6	54.0	3.3
259	5	4	8	3	4	8	8	8	6	6	7	0	0	6	3	9	6	91.0	2.7
260	5	4	7	7	4	8	8	8	6	6	7	7	6	7	2	5	6	103.0	1.6
261	5	4	0	0	4	8	3	3	6	6	0	2	2	0	6	4	6	59.0	2.5
262	5	4	8	0	4	8	8	8	5	6	0	7	0	0	6	8	6	83.0	3.1
263	4	4	7	7	4	8	3	8	6	5	2	0	0	0	6	4	0	68.0	2.8
264	5	4	8	3	4	8	8	5	6	6	7	7	0	0	6	8	6	91.0	2.5
265	5	4	4	7	4	3	0	5	6	6	0	0	0	0	6	4	0	54.0	2.6
266	4	0	8	0	4	2	0	0	6	3	0	0	2	0	6	0	0	35.0	2.7
267	5	4	8	7	4	8	0	0	6	6	0	0	2	0	6	7	6	69.0	3.1
268	5	4	2	3	4	8	5	3	6	2	7	0	0	7	6	6	6	74.0	2.4

Group II (CR items)																			
Student	1.1(5)	1.2(4)	1.3(())	1.4(7)	2.1(4)	2.2.1(())	2.2.2(())	2.3(())	3.1(6)	3.2(6)	3.3(7)	3.4(7)	3.5(4)	4.1(7)	4.2.1(6)	4.2.1(9)	4.3(6)	Means st	SD st
269	5	4	8	0	0	8	7	8	0	4	0	0	0	7	6	6	0	63.0	3.4
270	5	4	8	7	4	6	5	8	0	3	7	0	0	7	6	2	6	78.0	2.7
271	5	4	8	7	4	8	8	8	6	4	0	0	0	0	6	9	6	83.0	3.2
272	5	0	8	3	4	8	8	3	6	6	0	0	2	0	6	7	6	72.0	3.0
273	5	4	8	3	4	8	8	8	6	6	7	0	2	0	6	9	6	90.0	2.8
274	0	4	7	7	4	0	8	8	5	6	0	0	0	0	5	0	0	54.0	3.3
275	5	4	8	7	4	8	3	8	6	6	7	0	2	0	7	6	6	87.0	2.6
276	5	4	8	7	4	8	8	8	6	6	7	6	4	7	6	9	6	109.0	1.5
277	5	4	8	4	4	8	8	5	0	6	0	5	2	0	6	9	6	80.0	2.9
278	5	4	8	3	4	8	8	8	6	6	0	7	4	7	6	8	6	98.0	2.2
279	4	4	7	7	4	8	7	8	5	2	0	3	0	0	5	0	6	70.0	2.9
280	5	4	8	7	4	8	8	8	6	6	0	7	4	7	6	9	6	103.0	2.2
281	5	4	7	7	4	8	8	8	6	6	4	7	0	7	6	7	6	100.0	2.0
282	5	4	8	7	4	8	8	8	6	6	7	7	2	7	6	9	6	108.0	1.8
283	5	4	8	7	4	8	8	8	6	6	7	7	2	7	0	7	6	100.0	2.3
284	5	4	8	7	4	8	8	8	6	6	0	7	4	7	6	9	6	103.0	2.2
285	5	4	5	3	0	8	0	8	6	6	0	0	0	0	6	9	6	66.0	3.3
286	5	4	8	7	4	8	0	8	6	6	7	4	0	7	6	9	6	95.0	2.6
287	5	4	8	4	4	8	8	8	6	4	0	3	0	7	6	9	6	90.0	2.7
288	5	4	7	7	4	8	7	8	6	6	0	6	2	7	6	7	0	90.0	2.5
289	5	4	5	7	0	8	5	8	0	6	6	7	2	0	6	7	6	82.0	2.7
290	5	0	8	3	4	8	8	5	6	4	0	2	0	7	6	7	6	79.0	2.8
291	5	0	8	0	4	8	0	3	6	5	0	0	0	0	6	7	6	58.0	3.2
292	5	4	7	4	0	8	0	3	6	6	7	2	0	0	6	4	0	62.0	2.8
293	5	4	8	7	0	8	0	3	4	0	0	0	0	0	6	7	0	52.0	3.2
294	5	4	8	0	4	2	0	3	6	4	0	0	0	7	6	7	6	62.0	2.8
295	5	4	0	0	0	8	0	8	6	4	0	0	0	0	6	5	0	46.0	3.1
296	5	4	2	7	4	8	0	8	6	6	7	7	0	0	5	7	0	76.0	3.0
297	3	4	3	0	4	2	0	8	0	0	0	0	0	7	5	4	0	40.0	2.7
298	5	4	8	0	4	0	0	3	6	0	5	0	0	0	0	0	0	35.0	2.7

Group II (CR items)																			
Student	1.1(5)	1.2(4)	1.3(())	1.4(7)	2.1(4)	2.2.1(())	2.2.2(())	2.3(())	3.1(6)	3.2(6)	3.3(7)	3.4(7)	3.5(4)	4.1(7)	4.2.1(6)	4.2.1(9)	4.3(6)	Means st	SD st
299	0	0	0	0	4	0	0	3	0	0	0	0	0	0	6	2	6	21.0	2.2
300	5	4	4	0	0	8	0	0	6	3	0	0	0	0	0	0	0	30.0	2.7
301	5	4	0	3	4	0	0	0	6	0	7	0	0	0	5	0	6	40.0	2.7
302	5	8	0	3	4	8	0	5	0	0	0	0	0	0	6	0	0	39.0	3.1
303	5	4	0	0	4	8	8	5	6	4	0	0	0	0	6	9	6	65.0	3.2
304	5	4	1	0	4	8	3	5	0	0	0	0	0	0	5	2	0	37.0	2.6
305	5	0	1	0	4	8	0	5	6	2	0	0	0	0	5	0	0	36.0	2.7
306	5	4	8	7	4	8	8	5	6	6	0	0	0	0	0	7	0	68.0	3.3
307	5	4	3	7	4	8	0	1	0	2	0	0	0	0	6	0	6	46.0	2.9
308	5	4	1	0	4	8	0	5	6	6	0	0	0	0	0	0	5	44.0	2.9
309	5	4	1	0	4	0	0	3	6	2	0	0	0	0	6	9	6	46.0	2.9
310	5	4	8	0	4	8	0	8	0	0	0	0	0	7	5	0	0	49.0	3.4
311	5	4	0	3	4	8	3	1	6	0	0	0	0	0	6	6	0	46.0	2.8
312	5	4	1	0	4	0	8	3	5	2	7	0	0	0	6	6	6	57.0	2.8
313	0	0	8	0	4	8	8	5	5	6	7	7	0	0	6	9	6	79.0	3.3
314	5	4	8	7	4	8	8	8	6	6	7	7	4	0	5	9	6	102.0	2.2
315	5	4	0	0	4	0	0	5	5	0	7	0	0	0	6	4	0	40.0	2.7
316	5	4	0	3	4	8	0	5	5	2	7	0	0	0	5	4	6	58.0	2.6
317	5	4	8	7	4	8	8	5	0	6	7	2	0	0	5	2	0	71.0	3.0
318	5	4	8	3	4	8	5	8	6	0	7	0	0	7	5	7	0	77.0	3.0
319	5	4	7	7	4	8	0	8	6	0	0	0	0	0	5	7	6	67.0	3.2
320	5	4	0	0	0	8	0	8	6	2	0	7	0	6	8	0	0	54.0	3.4
321	5	4	1	0	0	6	0	3	0	0	0	0	0	7	0	9	0	35.0	3.0
322	5	0	1	0	4	5	0	8	0	2	0	0	0	0	5	4	0	34.0	2.6
323	5	4	0	7	4	8	0	5	0	0	7	0	0	7	6	3	6	62.0	3.0
324	5	0	1	0	0	2	0	8	0	2	7	0	0	7	6	4	6	48.0	3.0
325	5	4	3	3	4	8	0	8	0	6	0	0	0	7	6	7	6	67.0	3.0
326	0	4	1	7	4	8	8	8	5	4	0	0	0	0	6	8	6	69.0	3.3

	Group II (CR items)																		
Student	1.1(5)	1.2(4)	1.3(())	1.4(7)	2.1(4)	2.2.1(())	2.2.2(())	2.3(())	3.1(6)	3.2(6)	3.3(7)	3.4(7)	3.5(4)	4.1(7)	4.2.1(6)	4.2.1(9)	4.3(6)	Means st	SD st
327	5	4	8	7	4	8	8	1	6	2	0	0	0	7	6	4	6	76.0	2.9
328	3	0	8	3	0	8	0	5	5	2	0	0	0	7	6	9	6	62.0	3.3
329	5	4	8	7	4	8	8	8	6	6	7	7	4	7	6	7	6	108.0	1.4
330	5	4	8	3	4	8	8	8	5	0	0	0	0	0	0	4	0	57.0	3.3
331	5	4	1	0	0	8	0	8	6	6	7	0	0	0	6	4	6	61.0	3.2
332	5	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	6	17.0	2.0
333	5	4	8	7	4	8	8	8	6	6	7	0	0	0	6	2	6	85.0	2.9
334	5	0	0	0	4	0	0	3	0	0	0	0	0	0	6	7	0	25.0	2.5
335	5	4	0	7	4	8	0	3	6	6	7	0	0	0	5	9	6	70.0	3.1
336	5	4	8	0	4	8	8	3	4	2	0	0	0	7	6	7	0	66.0	3.1
337	5	4	8	7	4	8	8	5	6	6	7	0	0	0	6	3	6	83.0	2.7
338	5	4	1	7	4	8	0	8	0	2	0	0	0	0	6	2	0	47.0	3.1
339	5	4	8	7	4	8	8	8	6	0	7	0	0	0	6	9	0	80.0	3.4
340	5	4	8	3	4	8	8	8	6	6	0	7	4	0	6	7	6	90.0	2.5
341	5	4	1	3	4	8	8	8	6	5	7	4	4	0	6	4	0	77.0	2.6
342	5	4	8	7	4	8	8	8	6	6	0	0	0	7	6	9	6	92.0	2.9
343	5	4	8	7	4	8	8	0	6	5	7	0	0	0	5	8	6	81.0	3.0
344	5	4	1	3	4	8	0	8	6	6	0	0	0	7	0	2	0	54.0	3.0
345	5	0	1	0	4	2	8	0	0	0	0	0	0	7	6	0	0	33.0	2.9
346	5	4	8	0	0	0	0	0	0	4	0	0	0	0	5	5	0	31.0	2.7
347	3	4	1	3	0	0	0	0	0	0	0	0	0	7	5	0	6	29.0	2.4
348	3	0	1	0	4	0	0	8	6	0	0	0	0	0	6	0	0	28.0	2.7
349	5	4	8	7	4	8	8	8	6	6	7	7	4	7	6	9	0	104.0	2.2
350	5	0	8	0	4	0	0	5	0	0	0	0	0	0	6	0	0	28.0	2.7
351	5	3	3	4	4	8	8	8	6	6	0	5	0	0	5	7	6	78.0	2.7

Group II (CR items)																			
Student	1.1(5)	1.2(4)	1.3(())	1.4(7)	2.1(4)	2.2.1(())	2.2.2(())	2.3(())	3.1(6)	3.2(6)	3.3(7)	3.4(7)	3.5(4)	4.1(7)	4.2.1(6)	4.2.1(9)	4.3(6)	Means st	SD st
352	5	0	8	0	4	8	8	8	6	6	0	0	7	0	6	9	0	75.0	3.6
353	5	0	1	0	4	8	7	8	6	4	0	0	0	0	6	8	0	57.0	3.4
354	3	4	8	7	4	8	0	8	6	6	0	0	0	7	6	6	0	73.0	3.2
355	1	0	1	3	0	0	0	3	0	0	0	0	0	7	4	4	6	29.0	2.3
356	5	4	2	7	4	8	8	3	6	6	7	4	0	7	6	9	6	92.0	2.3
357	5	4	8	0	0	8	8	8	6	6	0	0	0	0	6	7	0	66.0	3.5
358	5	4	8	7	4	8	8	5	6	6	7	7	0	7	6	7	6	101.0	2.0
359	0	4	8	7	4	8	8	8	6	6	7	5	0	0	6	2	0	79.0	3.1
360	5	4	7	7	0	8	0	3	6	5	7	0	0	0	6	6	0	64.0	3.1
361	5	4	3	3	4	7	8	8	6	4	0	0	0	0	6	1	0	59.0	2.9
362	5	4	8	3	4	8	8	3	6	4	7	5	0	0	6	9	0	80.0	2.9
363	5	4	6	4	4	0	8	8	5	4	7	0	0	0	6	4	0	65.0	2.9
364	5	4	1	0	0	2	3	3	0	2	0	0	0	7	6	0	0	33.0	2.4
365	5	0	0	0	4	7	0	8	6	4	0	0	0	0	5	7	0	46.0	3.1
366	5	4	0	0	4	8	3	0	6	0	0	0	0	0	6	7	0	43.0	3.0
367	5	4	8	7	4	4	8	1	6	6	0	5	4	0	6	9	0	77.0	2.9
368	5	4	3	0	4	4	0	0	6	2	0	0	2	0	5	4	6	45.0	2.3
369	5	4	8	0	0	8	8	8	6	5	0	2	0	0	6	4	0	64.0	3.3
370	5	4	8	7	4	8	7	8	6	6	7	2	6	9	6	0	7	100.0	2.3
371	5	8	4	7	4	8	8	5	6	6	0	0	0	0	6	7	6	80.0	3.0
372	5	4	8	7	4	0	0	8	6	6	0	0	0	0	6	9	6	69.0	3.3
373	5	0	3	0	4	8	0	3	0	6	0	0	0	0	6	0	0	35.0	2.8
374	5	4	8	3	4	8	8	8	6	6	0	7	0	0	0	4	6	77.0	3.0
375	5	4	8	0	4	8	0	8	6	6	7	0	0	0	6	7	6	75.0	3.2
376	5	0	3	3	4	8	0	8	6	5	7	0	0	7	6	7	6	75.0	2.9

Group II (CR items)																			
Student	1.1(5)	1.2(4)	1.3(())	1.4(7)	2.1(4)	2.2.1(())	2.2.2(())	2.3(())	3.1(6)	3.2(6)	3.3(7)	3.4(7)	3.5(4)	4.1(7)	4.2.1(6)	4.2.1(9)	4.3(6)	Means st	SD st
377	5	4	5	7	4	8	8	8	6	6	7	5	4	7	6	6	6	102.0	1.4
378	3	4	0	0	4	0	0	3	0	0	0	0	0	0	6	2	0	22.0	2.0
379	5	0	7	0	4	0	0	8	0	0	0	0	0	0	6	0	6	36.0	3.1
380	5	0	3	0	4	8	0	5	0	6	7	0	0	0	6	8	0	52.0	3.2
381	5	4	8	7	4	8	0	8	6	4	7	0	0	7	5	4	6	83.0	2.7
382	5	4	8	0	4	8	0	8	0	4	0	0	0	0	6	8	0	55.0	3.4
Means item	4.5	3.2	5.0	3.5	3.4	6.3	4.4	5.7	4.1	3.7	2.8	1.7	0.8	2.7	5.2	5.5	3.6	66.2	0.8
SD item	1.2	1.8	3.4	3.1	1.6	3.0	3.8	2.7	2.6	2.5	3.4	2.7	1.6	3.4	1.9	3.1	2.9		

Table 6.60. Data of 382 examinees grades in Group III (lab CR items), Chemistry Exam 1st Phase, 2005.

Group III (CR items)								
Student	1(())	2(4)	3(6)	4(4)	5(4)	6(4)	Means st	SD st
1	8	4	6	0	4	0	22.0	3.2
2	8	4	0	4	4	0	20.0	3.0
3	8	4	6	4	4	0	26.0	2.7
4	3	0	6	4	4	0	17.0	2.4
5	8	4	6	4	4	0	26.0	2.7
6	8	4	0	4	4	0	20.0	3.0
7	4	4	1	4	4	4	21.0	1.2
8	5	4	6	4	4	4	27.0	0.8
9	8	0	6	0	4	0	18.0	3.5
10	5	4	0	4	4	0	17.0	2.2
11	8	4	6	4	4	0	26.0	2.7
12	8	4	0	4	4	4	24.0	2.5
13	3	4	0	4	4	0	15.0	2.0
14	3	4	6	4	4	4	25.0	1.0
15	8	4	0	4	4	0	20.0	3.0
16	5	4	0	4	4	0	17.0	2.2
17	8	4	6	4	4	0	26.0	2.7
18	8	4	6	4	4	0	26.0	2.7
19	8	0	0	0	0	0	8.0	3.3
20	8	0	6	4	4	0	22.0	3.2
21	8	4	0	4	4	0	20.0	3.0
22	8	4	6	4	4	0	26.0	2.7
23	5	4	6	0	4	0	19.0	2.6
24	8	4	0	4	4	0	20.0	3.0
25	8	4	6	4	4	4	30.0	1.7
26	8	0	6	4	4	0	22.0	3.2
27	8	4	6	4	4	4	30.0	1.7
28	5	0	0	0	0	0	5.0	2.0
29	8	4	6	0	4	0	22.0	3.2
30	5	4	6	0	4	4	23.0	2.0
31	5	0	6	0	4	0	15.0	2.8
32	8	4	6	4	4	0	26.0	2.7
33	8	4	0	0	4	0	16.0	3.3
34	8	4	6	4	4	4	30.0	1.7
35	8	4	6	4	4	0	26.0	2.7
36	3	4	6	4	4	4	25.0	1.0
37	8	4	0	4	0	0	16.0	3.3
38	5	4	6	4	4	4	27.0	0.8
39	5	0	0	0	0	0	5.0	2.0
40	8	4	6	4	4	0	26.0	2.7

Group III (CR items)								
Student	1(())	2(4)	3(6)	4(4)	5(4)	6(4)	Means st	SD st
41	6	0	0	4	4	0	14.0	2.7
42	8	4	0	4	4	0	20.0	3.0
43	8	0	0	4	0	0	12.0	3.3
44	1	4	6	4	0	0	15.0	2.5
45	3	0	0	0	0	0	3.0	1.2
46	5	0	0	0	4	0	9.0	2.3
47	8	4	4	4	6	0	26.0	2.7
48	3	0	0	0	0	0	3.0	1.2
49	3	4	6	0	4	0	17.0	2.4
50	3	4	0	0	4	0	11.0	2.0
51	3	4	0	4	4	0	15.0	2.0
52	3	0	0	0	4	0	7.0	1.8
53	3	0	0	0	4	0	7.0	1.8
54	5	0	0	0	0	0	5.0	2.0
55	1	0	0	4	4	0	9.0	2.0
56	8	0	0	4	4	0	16.0	3.3
57	5	4	0	4	0	0	13.0	2.4
58	3	4	0	0	4	0	11.0	2.0
59	5	0	0	4	4	0	13.0	2.4
60	5	0	6	4	4	0	19.0	2.6
61	8	4	0	4	4	4	24.0	2.5
62	5	0	0	0	4	4	13.0	2.4
63	5	0	0	0	4	0	9.0	2.3
64	3	0	0	0	0	0	3.0	1.2
65	1	0	6	0	0	0	7.0	2.4
66	5	4	6	4	4	4	27.0	0.8
67	3	4	6	4	4	4	25.0	1.0
68	5	0	6	4	4	4	23.0	2.0
69	1	0	0	0	4	0	5.0	1.6
70	5	4	6	4	4	4	27.0	0.8
71	0	0	0	4	0	4	8.0	2.1
72	3	0	0	4	4	0	11.0	2.0
73	0	0	0	4	4	0	8.0	2.1
74	5	0	0	0	0	7	12.0	3.2
75	3	0	0	4	4	0	11.0	2.0
76	3	4	6	4	4	0	21.0	2.0
77	5	0	6	0	0	0	11.0	2.9
78	8	4	6	0	4	4	26.0	2.7
79	0	0	0	0	0	0	0.0	0.0
80	5	0	6	4	4	0	19.0	2.6
81	1	0	0	4	0	0	5.0	1.6
82	8	4	6	4	4	0	26.0	2.7
83	5	0	6	4	4	0	19.0	2.6

Group III (CR items)								
Student	1(())	2(4)	3(6)	4(4)	5(4)	6(4)	Means st	SD st
84	5	4	0	4	4	0	17.0	2.2
85	3	4	6	0	0	0	13.0	2.6
86	3	4	6	0	4	4	21.0	2.0
87	8	0	0	0	4	0	12.0	3.3
88	1	0	0	0	0	0	1.0	0.4
89	8	4	6	0	4	0	22.0	3.2
90	5	0	0	0	0	0	5.0	2.0
91	5	0	0	0	0	0	5.0	2.0
92	0	0	0	0	0	0	0.0	0.0
93	3	0	6	4	4	0	17.0	2.4
94	3	0	0	0	0	0	3.0	1.2
95	8	4	6	0	4	0	22.0	3.2
96	3	4	6	4	0	4	21.0	2.0
97	1	0	0	4	4	0	9.0	2.0
98	3	0	0	0	0	0	3.0	1.2
99	0	4	0	0	0	0	4.0	1.6
100	5	4	6	4	4	0	23.0	2.0
101	8	4	6	4	0	0	22.0	3.2
102	5	4	6	4	4	0	23.0	2.0
103	3	0	0	4	4	4	15.0	2.0
104	0	3	6	4	4	0	17.0	2.4
105	1	0	6	4	4	4	19.0	2.2
106	8	0	6	4	4	0	22.0	3.2
107	8	4	6	4	4	0	26.0	2.7
108	3	0	0	0	4	0	7.0	1.8
109	1	0	6	0	4	0	11.0	2.6
110	5	4	6	4	4	0	23.0	2.0
111	5	4	6	4	4	0	23.0	2.0
112	5	0	0	0	0	0	5.0	2.0
113	3	0	0	4	0	0	7.0	1.8
114	3	0	6	4	4	0	17.0	2.4
115	8	0	0	4	4	0	16.0	3.3
116	0	0	6	0	4	0	10.0	2.7
117	8	4	0	4	0	0	16.0	3.3
118	3	0	0	4	4	0	11.0	2.0
119	5	0	0	4	0	0	9.0	2.3
120	8	4	6	4	4	0	26.0	2.7
121	8	0	6	4	0	0	18.0	3.5
122	8	4	6	4	4	0	26.0	2.7
123	5	0	6	0	4	0	15.0	2.8
124	8	4	6	0	4	0	22.0	3.2
125	8	4	6	4	4	4	30.0	1.7
126	3	4	0	0	0	0	7.0	1.8

Group III (CR items)								
Student	1(())	2(4)	3(6)	4(4)	5(4)	6(4)	Means st	SD st
127	1	0	4	0	0	0	5.0	1.6
128	3	0	0	0	4	0	7.0	1.8
129	8	4	6	4	4	0	26.0	2.7
130	8	4	0	0	4	0	16.0	3.3
131	8	0	0	4	4	0	16.0	3.3
132	8	4	6	4	4	0	26.0	2.7
133	8	4	6	4	4	0	26.0	2.7
134	5	0	0	0	4	4	13.0	2.4
135	8	4	6	4	4	0	26.0	2.7
136	5	0	0	0	0	4	9.0	2.3
137	3	4	0	0	4	0	11.0	2.0
138	8	4	6	0	4	4	26.0	2.7
139	3	4	6	4	4	0	21.0	2.0
140	3	4	0	4	4	0	15.0	2.0
141	8	4	6	0	4	0	22.0	3.2
142	8	4	6	0	4	0	22.0	3.2
143	5	0	0	4	4	4	17.0	2.2
144	8	0	0	4	0	0	12.0	3.3
145	3	4	6	4	4	4	25.0	1.0
146	5	0	0	4	4	4	17.0	2.2
147	3	0	6	4	4	0	17.0	2.4
148	5	0	0	4	4	0	13.0	2.4
149	1	4	6	4	4	0	19.0	2.2
150	5	4	6	0	4	0	19.0	2.6
151	5	0	6	4	4	0	19.0	2.6
152	8	0	0	0	0	0	8.0	3.3
153	8	4	0	4	4	0	20.0	3.0
154	8	0	0	0	4	0	12.0	3.3
155	1	4	0	0	4	4	13.0	2.0
156	1	0		4	4	0	9.0	2.0
157	8	4	6	4	4	4	30.0	1.7
158	3	0	4	0	0	0	7.0	1.8
159	3	0	0	0	4	0	7.0	1.8
160	5	0	0	0	0	0	5.0	2.0
161	3	0	6	4	0	0	13.0	2.6
162	3	0	0	0	4	0	7.0	1.8
163	3	4	6	4	4	4	25.0	1.0
164	5	4	6	0	4	0	19.0	2.6
165	3	0	6	0	4	0	13.0	2.6
166	8	4	6	4	4	0	26.0	2.7
167	1	0	0	4	0	4	9.0	2.0
168	3	0	0	0	0	0	3.0	1.2
169	5	0	6	0	4	0	15.0	2.8

Group III (CR items)								
Student	1(())	2(4)	3(6)	4(4)	5(4)	6(4)	Means st	SD st
170	8	0	0	0	0	0	8.0	3.3
171	8	4	6	4	4	0	26.0	2.7
172	3	4	6	4	4	0	21.0	2.0
173	8	4	6	4	4	4	30.0	1.7
174	8	4	6	4	4	0	26.0	2.7
175	8	4	6	0	4	0	22.0	3.2
176	3	4	6	4	4	0	21.0	2.0
177	8	4	6	4	4	0	26.0	2.7
178	8	4	0	4	4	4	24.0	2.5
179	3	0	6	0	0	0	9.0	2.5
180	3	4	6	4	4	0	21.0	2.0
181	8	4	6	4	4	4	30.0	1.7
182	8	4	0	4	4	0	20.0	3.0
183	5	4	6	4	4	0	23.0	2.0
184	8	4	6	4	4	0	26.0	2.7
185	3	4	6	4	4	0	21.0	2.0
186	8	4	0	0	4	0	16.0	3.3
187	8	4	6	4	4	4	30.0	1.7
188	8	4	6	4	4	4	30.0	1.7
189	5	0	0	0	0	0	5.0	2.0
190	5	0	0	0	0	0	5.0	2.0
191	8	4	6	4	4	0	26.0	2.7
192	8	4	0	4	4	0	20.0	3.0
193	8	4	6	4	4	0	26.0	2.7
194	5	4	6	4	4	0	23.0	2.0
195	8	4	6	0	4	0	22.0	3.2
196	3	0	4	0	0	0	7.0	1.8
197	5	4	6	4	4	4	27.0	0.8
198	3	0	0	0	4	0	7.0	1.8
199	8	4	6	4	4	0	26.0	2.7
200	8	4	6	4	4	0	26.0	2.7
201	3	0	0	4	0	0	7.0	1.8
202	8	4	6	4	4	0	26.0	2.7
203	3	0	6	0	0	0	9.0	2.5
204	5	0	0	4	4	0	13.0	2.4
205	5	4	0	4	4	0	17.0	2.2
206	5	0	6	0	4	0	15.0	2.8
207	8	4	0	4	4	0	20.0	3.0
208	8	4	6	4	4	4	30.0	1.7
209	8	4	0	4	4	4	24.0	2.5
210	3	0	0	0	4	0	7.0	1.8
211	8	0	0	0	0	0	8.0	3.3
212	8	4	0	4	4	4	24.0	2.5

Group III (CR items)								
Student	1()	2(4)	3(6)	4(4)	5(4)	6(4)	Means st	SD st
213	8	4	0	0	0	0	12.0	3.3
214	8	4	0	0	4	0	16.0	3.3
215	3	4	6	0	4	4	21.0	2.0
216	3	0	6	0	4	0	13.0	2.6
217	3	0	0	0	4	0	7.0	1.8
218	8	4	6	4	4	0	26.0	2.7
219	3	4	6	4	4	4	25.0	1.0
220	8	4	6	0	0	0	18.0	3.5
221	8	0	0	4	4	0	16.0	3.3
222	3	4	6	4	0	0	17.0	2.4
223	8	4	6	0	4	4	26.0	2.7
224	3	4	6	4	4	0	21.0	2.0
225	5	4	6	4	0	0	19.0	2.6
226	5	4	0	4	4	0	17.0	2.2
227	5	4	6	4	4	4	27.0	0.8
228	8	4	0	4	4	0	20.0	3.0
229	8	4	0	0	0	0	12.0	3.3
230	8	4	6	4	4	0	26.0	2.7
231	1	4	0	0	4	0	9.0	2.0
232	3	0	0	0	0	0	3.0	1.2
233	8	4	6	0	4	0	22.0	3.2
234	5	0	6	4	4	0	19.0	2.6
235	8	4	6	4	4	0	26.0	2.7
236	8	4	6	4	4	0	26.0	2.7
237	5	4	6	4	4	0	23.0	2.0
238	8	4	6	4	4	0	26.0	2.7
239	8	4	0	4	4	0	20.0	3.0
240	5	0	6	4	4	0	19.0	2.6
241	8	4	0	0	4	0	16.0	3.3
242	5	4	6	4	4	0	23.0	2.0
243	5	4	0	4	4	0	17.0	2.2
244	5	4	6	4	4	4	27.0	0.8
245	8	4	6	4	4	0	26.0	2.7
246	8	4	6	4	4	4	30.0	1.7
247	8	4	6	0	4	0	22.0	3.2
248	5	4	6	4	4	4	27.0	0.8
249	8	4	0	4	4	0	20.0	3.0
250	8	4	6	4	4	0	26.0	2.7
251	3	0	0	4	4	0	11.0	2.0
252	8	0	0	0	4	0	12.0	3.3
253	8	4	6	4	4	4	30.0	1.7
254	5	4	6	4	4	4	27.0	0.8
255	5	4	0	0	4	0	13.0	2.4

Group III (CR items)								
Student	1(())	2(4)	3(6)	4(4)	5(4)	6(4)	Means st	SD st
256	8	4	6	4	4	4	30.0	1.7
257	8	0	6	4	4	0	22.0	3.2
258	8	4	6	0	4	0	22.0	3.2
259	8	4	6	4	4	0	26.0	2.7
260	8	4	6	0	4	4	26.0	2.7
261	8	4	6	0	4	0	22.0	3.2
262	8	0	4	6	4	0	22.0	3.2
263	8	4	6	4	4	4	30.0	1.7
264	8	4	6	0	4	0	22.0	3.2
265	8	4	0	0	4	0	16.0	3.3
266	8	4	0	0	0	0	12.0	3.3
267	1	0	0	4	4	0	9.0	2.0
268	3	0	6	0	4	4	17.0	2.4
269	8	0	0	4	0	0	12.0	3.3
270	8	4	6	0	4	0	22.0	3.2
271	5	4	6	4	4	4	27.0	0.8
272	3	4	0	4	4	4	19.0	1.6
273	8	4	0	4	4	0	20.0	3.0
274	8	4	6	0	4	4	26.0	2.7
275	8	4	6	4	4	4	30.0	1.7
276	8	4	6	4	4	0	26.0	2.7
277	8	4	6	0	4	4	26.0	2.7
278	8	4	6	4	4	4	30.0	1.7
279	8	4	6	4	4	4	30.0	1.7
280	5	4	6	4	4	4	27.0	0.8
281	8	4	6	4	4	4	30.0	1.7
282	8	4	6	4	4	4	30.0	1.7
283	3	4	6	4	4	4	25.0	1.0
284	8	4	6	4	4	4	30.0	1.7
285	3	4	6	4	4	0	21.0	2.0
286	8	4	6	4	0	4	26.0	2.7
287	3	4	0	0	4	4	15.0	2.0
288	1	4	6	0	4	0	15.0	2.5
289	5	4	6	4	4	0	23.0	2.0
290	8	4	0	4	4	4	24.0	2.5
291	5	4	6	4	4	0	23.0	2.0
292	5	4	6	0	4	0	19.0	2.6
293	5	4	6	4	4	0	23.0	2.0
294	5	0	0	0	4	0	9.0	2.3
295	3	4	6	4	4	0	21.0	2.0
296	8	0	6	4	4	0	22.0	3.2
297	3	0	0	0	4	0	7.0	1.8
298	3	0	4	0	0	0	7.0	1.8

Group III (CR items)								
Student	1(())	2(4)	3(6)	4(4)	5(4)	6(4)	Means st	SD st
299	3	0	6	4	4	4	21.0	2.0
300	1	0	0	0	4	0	5.0	1.6
301	3	0	0	0	0	0	3.0	1.2
302	3	0	0	4	4	4	15.0	2.0
303	3	4	6	0	4	0	17.0	2.4
304	3	4	0	4	0	0	11.0	2.0
305	1	0	0	0	0	0	1.0	0.4
306	8	4	0	4	4	0	20.0	3.0
307	3	0	0	0	0	0	3.0	1.2
308	1	0	0	0	0	0	1.0	0.4
309	5	0	0	0	4	0	9.0	2.3
310	0	0	0	0	4	0	4.0	1.6
311	3	0	6	0	0	0	9.0	2.5
312	8	4	6	4	0	4	26.0	2.7
313	1	6	4	4	0	4	19.0	2.2
314	8	4	6	4	4	4	30.0	1.7
315	3	4	0	0	4	0	11.0	2.0
316	8	4	6	0	4	0	22.0	3.2
317	0	0	0	0	4	0	4.0	1.6
318	8	0	6	0	4	0	18.0	3.5
319	5	4	6	4	4	0	23.0	2.0
320	8	4	0	0	4	0	16.0	3.3
321	8	0	0	4	0	0	12.0	3.3
322	0	4	6	0	0	0	10.0	2.7
323	5	4	0	0	4	0	13.0	2.4
324	5	4	6	4	4	0	23.0	2.0
325	0	4	0	0	4	0	8.0	2.1
326	5	0	0	4	0	4	13.0	2.4
327	8	0	0	0	4	0	12.0	3.3
328	0	0	6	0	0	0	6.0	2.4
329	8	4	6	4	4	4	30.0	1.7
330	8	4	6	0	0	0	18.0	3.5
331	3	0	0	4	4	0	11.0	2.0
332	8	0	6	0	0	0	14.0	3.7
333	8	4	6	4	4	0	26.0	2.7
334	3	0	0	0	0	0	3.0	1.2
335	3	4	6	4	4	0	21.0	2.0
336	3	0	0	4	4	0	11.0	2.0
337	1	0	6	4	4	0	15.0	2.5
338	0	0	0	0	4	0	4.0	1.6
339	3	0	0	4	4	0	11.0	2.0
340	8	4	6	4	4	4	30.0	1.7
341	8	4	6	4	4	4	30.0	1.7

Group III (CR items)								
Student	1(())	2(4)	3(6)	4(4)	5(4)	6(4)	Means st	SD st
342	5	4	6	4	4	4	27.0	0.8
343	3	4	6	4	4	0	21.0	2.0
344	5	4	0	0	4	0	13.0	2.4
345	8	0	0	4	0	4	16.0	3.3
346	3	0	0	0	0	4	7.0	1.8
347	3	0	6	0	0	0	9.0	2.5
348	1	0	0	0	0	0	1.0	0.4
349	5	4	6	4	4	4	27.0	0.8
350	3	4	6	0	4	0	17.0	2.4
351	5	4	6	4	4	4	27.0	0.8
352	1	4	6	0	4	4	19.0	2.2
353	8	0	6	4	4	4	26.0	2.7
354	5	4	0	4	4	0	17.0	2.2
355	5	0	6	0	0	0	11.0	2.9
356	4	6	4	0	0	0	14.0	2.7
357	3	0	0	4	4	4	15.0	2.0
358	8	0	6	4	4	4	26.0	2.7
359	8	4	6	0	4	0	22.0	3.2
360	3	0	6	0	4	0	13.0	2.6
361	8	4	6	4	0	4	26.0	2.7
362	5	4	0	0	4	0	13.0	2.4
363	0	0	0	0	0	0	0.0	0.0
364	8	0	0	0	4	0	12.0	3.3
365	5	4	6	4	4	0	23.0	2.0
366	5	4	6	4	4	0	23.0	2.0
367	8	4	6	4	4	0	26.0	2.7
368	0	0	0	0	0	0	0.0	0.0
369	0	0	0	4	4	0	8.0	2.1
370	8	4	6	4	4	4	30.0	1.7
371	5	0	4	0	4	4	17.0	2.2
372	1	4	6	0	4	4	19.0	2.2
373	3	0	6	4	0	0	13.0	2.6
374	3	4	6	4	4	0	21.0	2.0
375	3	0	0	0	4	0	7.0	1.8
376	0	0	0	4	0	0	4.0	1.6
377	1	4	0	4	0	4	13.0	2.0
378	1	0	0	0	0	0	1.0	0.4
379	5	0	0	0	0	0	5.0	2.0
380	3	0	0	0	4	4	11.0	2.0
381	8	4	6	0	4	0	22.0	3.2
382	3	0	6	4	4	0	17.0	2.4
Means item	5.2	2.4	3.4	2.4	3.1	1.0	17.4	1.4
SD item	2.6	2.0	2.9	2.0	1.7	1.8		