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NEW PERSPECTIVE ON DEVELOPING TECHNICAL AND SOFT SKILLS FOR IS GRADUATES – THE CASE OF SYSTEM ANALYSIS AND DESIGN WORKSHOP

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Abstract

Information Systems (IS) curricula should provide students with both technical and non-technical (soft) skills. The technical aspects are covered by various programming and system analysis and design courses. However, soft skills like teamwork, interpersonal communication, presentation delivery, and others are hardly covered. Employers, who consider both technical and soft skills to be equally important, search for professional Information Systems employees possessing both. These employers often complain that finding an IS graduate with both types of skills is quite difficult. The IS'2009 Model Curriculum refers to both types of skills, considering them an essential part of the graduate knowledge base. However, in many cases the soft skills are not sufficiently addressed, and even if they are, it is not necessarily in the context of software development project. The SA&D course provides an important foundation for the IS profession. This is especially true due to the emerging role of the programmer-analyst who is responsible not only for programming but also for some analysis work. In order to strengthen the soft skills in the context of system analysis and design, we suggest a workshop structure emphasizing these soft skills while students analyze and design a complete information system. Our SA&D workshop includes some face-to-face lectures and heavy team based collaborations. The students have many online activities, including teamwork, interviews with simulated clients, team-based peer reviews, presentation delivery and so forth. The workshop employs a grade difference calculation mechanism that revealed, along with the students' reflections that the workshop structure enhanced the students' ability to cope with the workshop assignments while strengthening their "soft" skills and preparing them for their future analysis and design challenges.

Keywords: *Systems Analysis and Design, Soft Skills, Peer Review, Practical Learning*

1 INTRODUCTION

The skills required by the industry from Information Systems (IS) workers include both technical and non-technical skills. Technical skills refer to professional methods for requirements elicitation and analysis, system design, human computer interface design, software validation and verification, software quality, software implementation and project management. Non-technical skills (also called soft skills) refer to communication, teamwork, collaboration, planning, subject leading, presentation delivery, writing skills, and work assessment. Many employers of IS workers consider both technical and non-technical skills to be equally important, and search for professional workers equipped with both types of skills (Bailey & Stefanizk, 2002; Noll & Wilkins, 2002). Also, graduate students possessing soft skills are often quickly placed on mission critical project teams (Stader, 2004). Moreover, industry leaders point out that when they recruit new graduate and have to choose between a candidate with highly developed technical qualities versus a candidate with highly developed interpersonal traits, the latter wins out most of the time (Russell et al 2005).

The IS'2009 curiculum guidelines for Undergraduate Degree Programs in Information Systems (Heikki Topi et-al, 2009) as well as the IS'2002 Model Curriculum (Gorgone, J. et-al, 2003) refer to both technical and non-technical skills, considering them as an essential part. The technical skills are usually learned through a series of courses that teach the student how to write and design efficient computer programs and how to build systems that address clients' needs. One of the core courses in almost every IS

program (for undergraduate students) is the System Analysis and Design (SA&D) course, in which the students learn how to turn clients' needs into qualitative information system through a System Development Lifecycle (SDLC). The SA&D course syllabus usually contains many technical issues concerned with analysis and design of information system, leaving only little time for the educators to deal with teamwork, communication, assessment or any other non-technical skills. Many educators promotes teamwork experience in the SA&D course by dividing the students into teams, and give them case studies on which each team practice various analysis and design techniques following the SDLC. While teamwork is promoted, most educators do not have sufficient time to guide the teams how to make an efficient teamwork: efficient time management, task plan and assignment, peer reviews, mutual feedbacks, conflict resolution, leadership and so forth. The submitted assignments are reviewed and graded by the educator (or his teaching assistants) only according to their technical quality. As a result, no significant learning of soft skills is achieved.

In their final year IS students are required to analyze, design and implement a complete information system by themselves (sometimes in groups) as part of their final project, as a preparation to real-world challenges. Although the project is supervised by educators, most supervisors do not give special attention to non-technical skills, grading only the technical aspects of the products. Since the supervisor does not take place in the development process, nor participate in meetings with clients, no feedback is given to the students regarding their work routine. Some IS programs include courses dedicated to communication, inter-personal relationship, project management or other non-technical skills, but in most cases the students do not practice these skills in the context of system development. Surprisingly as it seems, many IS graduates have never participated peer reviews, assessed colleagues' work products, delivered a presentation based on their work, or even learned good teamwork methods during their studies. As a result, many IS graduates lack essential skills required by the industry, and have to acquire these skills through work experience. For this reason, the IS programs should consider new approaches to teach these soft skills along with the technical ones, providing the students knowledge and experience required for this profession.

Many papers in the last years have suggested new approaches to the teaching of soft skills, most of them deal with teams and capstone projects in IS programs (Russell and Russell 2006; Russell et al 2005; Schatzberg 2003; Folse, et al 2003; Frandsen and Rhodes 2002; Owen 2001).

In this paper the authors describe a SA&D workshop given as part of the Management Information systems (MIS) program. The SA&D workshop is given following the SA&D course, in concurrence with the final project. The students practice technical and non-technical skills while planning, analyzing and designing an information system. The authors believe that such a workshop can provide the students the necessary skills in the right context, prepare the students to real-world challenges, and turn their final project to be more effective. The authors recommend the adoption of the SA&D workshop as part of the IS program.

2 THE STUDY

In this section we present the workshop structure, including the participating students. We also present information as regards to the various assignments given during the workshop, the timetable of the assignments and the grading scheme. Finally we present information regarding the methodology used for evaluating the learning process.

2.1 About the Study Participants

Our action research took place within the systems analysis and design workshop which is a mandatory course taken during the third (and last) year of the studies, acquitting 3 credit points to the participants. The workshop objectives are to prepare the students for their final project and for the real world challenges they will face. At this stage the students have a good understanding of the technical knowledge areas required for the workshop (software engineering, software modeling, UML usage,

etc.), however, most of them still lack the non-technical knowledge areas (such as critical thinking and abilities to provide meaningful and helpful feedback). For that reason, the workshop focuses on practice, "hands-on", and team based activities. Yet, the workshop augments knowledge and understanding gained in previous courses to elaborate the students' technical skills. There was a high degree of fluctuations in the number of student over the years, however, since most of the study in the workshop in performed in teams, more students implies more teams, but the structure remains unchanged.

2.2 The Course

During the first lecture, the students were instructed to form teams. Usually there were 4 students on a team. Each team received and worked on its own case study. The case study included a general description of a virtual customer and a business case. The main reason for using a different story for each team was to make sure the evaluating team spends the required time in learning and evaluating the document and the ideas presented and not relating to their own ideas. The students had to study their story, address the problems presented in the business case and suggest ways (and a software based system) to solve the problems and achieve the customer's goals (which were not entirely defined in most cases). The workshop structure was based on incremental assignments that follow the software development life-cycle. For each assignment the students had 2-3 weeks in which they worked by themselves and together, used various collaborative tools, and consulted the instructor (via email, the workshop web site, and personal meetings). Although usually students are on a tight schedule, and they learned how to use various collaborative tools (live Workspace, messaging service, etc), one of the aims of the workshop is to address this type of tools. The team based learning employed in this workshop does not imply real face to face meetings, but rather using technology for achieving this goal. The workshop requirements included two types of deliverables (assignments): (1) team assignments, and (2) personal assignments.

2.3 The Workshop Timeline

The workshop structure is quite complicated and the amount of the required work is significant and for that reason there are 4 students in each team. The workshop employs a LEGO like approach of modular assignments that require a strict schedule. Each one of the team assignments is reviewed, evaluated and graded twice once by the instructor and a second time by another team. For condensing all assignments into a standard 13 week semester, these activities are performed in parallel. After an assignment was submitted it was distributed to a different team for review and evaluation. Each team has to review, assess and grade the assignments they received in parallel to start preparing their next document. The schedule assures that the feedback (both from the instructor, as well as from the evaluating team) will be available at least one full week prior to the submission date of the next assignments, so it can be taken into consideration. For stressing the user centric approach, the workshop includes two face-to-face simulation sessions: (1) requirements gathering (1 hour for each team in which the students meet the "customer") and (2) "user" meeting (1 hour for each team in which the students meet the "user" to discuss various design issues related to the solution to be defined). This section provides a table of activities for better understanding the workshop structure by outlining the students' activities along the semester timeline (a standard 13 weeks), as seen on Table 1.

Week	Class Activity	Students Activity
1	Lecture (Introduction, The Business Environment, Project Initiation & Management)	Form team; nominate team leader, who is responsible for managing the workload among the team members; get a story and start understanding the "customer" and the problems presented
2	Lecture (Projects identification and selection, requirements engineering)	Initiate and plan the project, Work on Project Initiation and planning document (1st assignment). Look for outside help (instructor) for addressing the problems. Apply learned

		principles on the story situation.
3	Lecture (Software modeling – process model, logical model)	Start requirements analysis; discuss and finalize 1st assignment; start working on an agreed upon list of questions and issues to be addressed.
4	Lecture (Software modeling – data model)	Prepare the "user" requirements gathering simulation (part 1); submit 1st assignment and get a document for review and grading; conduct meetings (or virtual meetings) to mutually discuss the reviewed document; prepare an agreed upon feedback and grade.
5	"User" requirements gathering simulation	Submit review and grade for evaluated document; analyze the requirements and work on the Analysis document (2nd assignment). Conduct face to face "customer" interviews for refining requirements
6	System modeling class (hands-on laboratory)	Finalize 2nd assignment by addressing all relevant information, review comments and suggestions.
7	System modeling class (hands-on laboratory)	Submit 2nd assignment and get a document for review and grading; conduct meetings (or virtual meetings) to mutually discuss the reviewed document; prepare an agreed upon feedback and grade.
8	User meetings simulation (Design requirements)	Submit review and grade for evaluated document; attend the "user" meetings for discussing various design issues; work on the Design document (3rd assignment).
9	Lecture (Project implementation)	Finalize 3rd assignment (address review comments and suggestions); start working on customer presentation.
10	Presentations	Submit 3rd assignment; start working on the Implementation Document (4th assignment); evaluate presentations and get a document for review and grading; Conduct face to face or digital "customer" interviews for refining requirements
11	Presentations	Finalize 4th assignment by addressing review comments and suggestions; evaluate presentations
12	Presentations	submit 4th assignment and get a document for review and grading; evaluate presentations; Conduct face to face or digital "customer" interviews for refining requirements
13	Presentations	Evaluate presentations; submit review and grade for document evaluated; prepare and submit personal report.

Table 1. Workshop Activities Timeline

2.4 Team Assignments

Three types of team assignments were included in the workshop: (1) compiling four documents; (2) reviewing four documents (which were prepared by other teams), and (3) preparing and delivering a class presentation.

2.4.1 Compiling the Documents

During the workshop the students has to submit four documents: (1) project initiation and planning; (2) system analysis; (3) system design, and (4) system implementation. The documents represent the common team perspective on the issue. For preparing a document, each team member had to read and evaluate the document by itself. After this evaluation, the team met (either in person or by using a collaborative tool), and discussed the findings. This consensus meeting was required for achieving a common unified solution, which was later translated into a document. Each one of the submitted documents had to follow a template which was provided in advance and posted on the workshop web site. Appendix I contains the template for the Initiation and Planning document. In addition, for each template, a consistent grading guideline was provided. Appendix II contains the grading guideline for the Analysis document. These guidelines outlined the relative grade assigned to each paragraph in the

document (or its relative importance). During the documents' preparation, the students should have considered the various issues related to their project, and take into account the relative weight assigned for each section.

2.4.2 Reviewing Documents

Each handed document was reviewed and assessed by another team, as well as by the instructor. The review was based on the document template and grading guidelines that were provided. This TBPR (Team Based Peer Review) enhanced the students' critical thinking capabilities as well as their required soft-skills (Covey, 1996). Working effectively as a team member is a vital skill for Information Systems graduates and is one of the objectives of the workshop. For participating in TBPR, each member must have good communication skills, including the ability to give and receive constructive criticism. The review process, like the document compilation process started with individual reviews followed by a team collaborative meeting in which they had to reach consensus and an agreeable assessment. Reviewing documents proved to be very important. In the process of reviewing documents prepared by different teams, the students were exposed to new possible solutions and it helped them acquire new ideas and knowledge.

2.4.3 Presentation

The presentation was a summary of all the team work performed and all team members had to participate. The presentation was defined as a technical selling presentations and the team, had to convince the customer that they understand the problems and are able to provide a suitable solution. The grade for the presentation was given on a team basis. This was done to stress the collective aspect of the work and to raise each member's personal accountability. The presentation followed a predefined template and it started with a brief description of the virtual customer, the business case, and associated problems. The main part of the presentation was a description of the information system proposed as a solution. In addition, the presentation related to risks associated with the project, the expected benefits, the timeframe, and preliminary cost estimates. There were 30 minutes allocated for each presentation including answering questions raised by the "customer" (the students and the instructor).

2.5 Personal Assignments

The personal assignments consisted of two parts: (1) reviewing, assessing, and evaluating the presentations given by all other teams, and (2) preparing a personal report to reflect a student's thoughts about the work performed and the workshop itself.

2.5.1 Evaluating Presentations

The evaluation form, available on the workshop web site, provided guidelines for the presentation. This evaluation form defined the relative grade for each of the issues related to the presentations, starting from technical issues and up to appearance (font size and colors) or timeframe. Every student assessed the presentation as if he or she were the customer. The main questions addressed the proposed solution and whether it convincingly solved the problems raised. The evaluation related to the team as a whole and the evaluating student had to provide an average for the team members' performance. Presentation skills (as well as technical skills) varied among the team members; however, it was their responsibility to rehearse as much as needed, so that the team-made presentation achieved the required outcome.

2.5.2 Personal Report

Each student prepared a personal report which consisted of several issues: (1) feedback on the proportional contribution of each of the other team members. This feedback was used to assess the

distribution of work among the team members, taking into account the team member's point of view. (This feedback also provided socio-metric data, which was interesting unto itself, but is beyond the scope of this paper.); (2) reflection on the work done by the team and by the student as part of the team, with special emphasis on the new experience gained by the individual student, and (3) reflection on the workshop as a whole, relating to benefits as well as suggested improvements.

2.6 The Workshop Grading Scheme

Each submitted document was reviewed and graded twice: once by the instructor and once by another team. Both assessments and grading were performed based on the common grading guidelines available on the workshop web site. The review process of the documents demands significant effort dedicated to evaluation of the work. The authors estimate that each document evaluation requires 60-90 minutes on average. The assignment grade was calculated using a weighted average, in which the instructor's grade weight was 80%, while the team's grade weight was 20%. However, this average was calculated only if the difference between the two grades was less than 16 points. If the difference was above 15 points, the students' evaluation grade was not taken into account in determining the submitting team's grade. Use of grading template served to enforce habits of precise and thorough analysis of documents, and to eliminate cases in which a team tried to improve (or spoil) the grades of a fellow team.

In addition to the assignment grade, each team was also graded for their review and evaluation of the other's documents. This grade was calculated based on the difference between the instructor's grade and the team's grade, and on the quality of the judgment processes expressed by the students and the feedback they provided in their review. The presentation prepared by the team was graded as well and this grade was mainly based on peer review.

2.7 Learning Process Evaluation Methodology

The pre-defined documents' template and grading schemes were used in order to avoid different variations of evaluation styles. The learning process methodology is based on the fact that each document was graded twice (by the instructor and by another team). Under ideal conditions, the instructor's grade should be very similar to the evaluating team grade. If learning occurs during the course of the workshop, a pattern of convergence will emerge. For each of the documents submitted, the difference between the instructor's grade and the evaluating team grade was calculated. The team's grades differences provide a simple methodology for tracking the learning patters of this specific team. However taking into account that (unfortunately) not all teams possess the same cognitive levels, team learning patterns are somewhat limited. For that reason, a class average per assignment was calculated. This average was very general, but it provided the true picture.

3 RESULTS AND CONCLUSION

The grade difference was calculated for the academic year 2007, in which a new electronic submission system was put to work. During this year, there were 35 students in the workshop, forming 8 teams. Analyzing the difference revealed that the initial class difference (for the first assignment) was quite low (9 point out of 100), which is attributed to the workshop's templates and guidelines. After the fourth assignment the average was reduced to 6 points (Figure 2). This pattern of convergence demonstrates that the students learned to evaluate. However, taking into account that these are complex evaluations that require analyzing many different variables (the virtual customer, the presented story, the business case and its problems, systems analysis principles, the document being evaluated, the grading scheme, etc.), good evaluations are actually learning demonstrators.

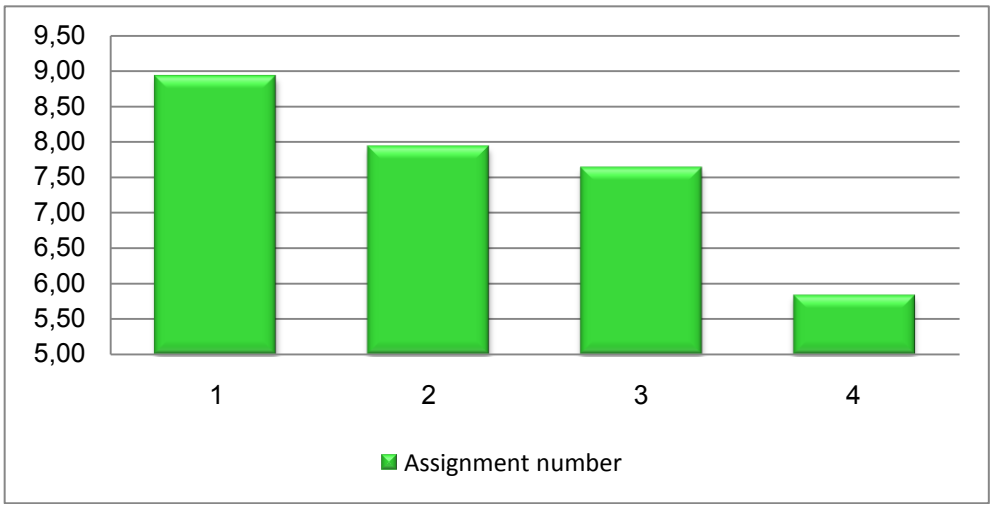

Figure 2. Average Grade Difference

However, in addition to the decreasing grade difference, the grades dispersion was reduced as well. This means that the observed learning patterns were applicable for all teams involved. Figure 3 depicts the average difference per assignment and in addition one Standard Deviation from the mean (σ1 = 8.8, σ2 = 7.9, σ3 = 7.3, σ4 = 4.8).

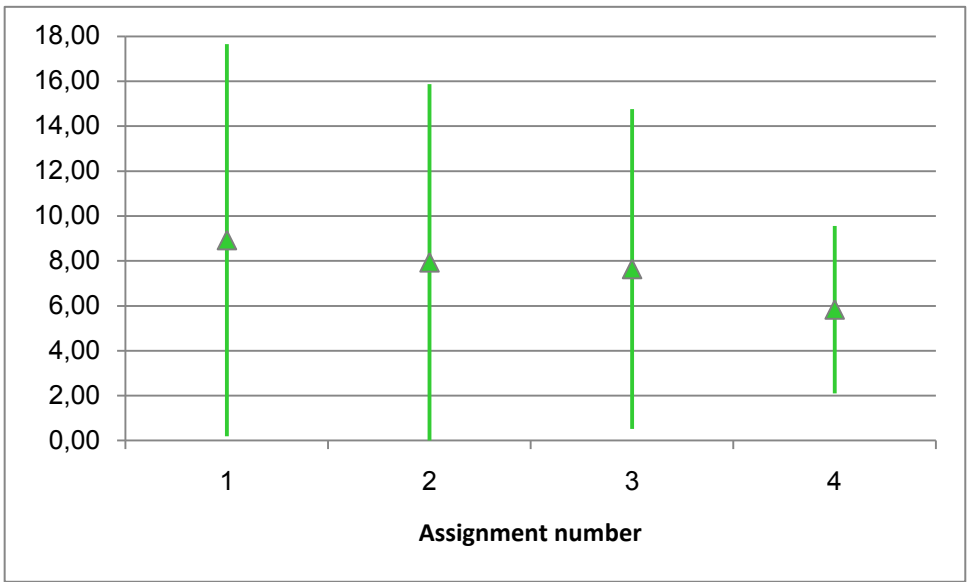

Figure 3. Average Grade Difference and dispersion (one SD from mean)

An additional indication for the learning process that occurred can be found in the students' reflections (as part of their personal report). Some common reflections related to the workshop include:

"I personally, learned many things, especially from what my team members did as well as from other students in the document they prepared (and which we evaluated)."

"Team work, both doing the assignments and evaluating other group work, is very important. We had cases in which the amount of coordination between the team members was not sufficient, and it was noticed in the resulting documents submitted."

"In the beginning we had some team problems (it took time before we learned how to work as a team), but by the end of the workshop it was much better."

"The methodology used was very good. Working in teams provides solutions that one person, sometimes doesn't see and the other teams' evaluation is very important and helped us design a better solution. The review we received from other teams (and the instructor) provided additional important knowledge."

These reflections provide the students' understanding that working in teams helped them improve their critical thinking. This relates to both preparing their assignments and evaluating their peer students' assignments. The students also realized that some basic preparations are needed before a successful engagement in team based activities. One of the most important team based activities was the combining of cognitive abilities (Yadin & Lavy, 2008). These results are consistent with Berkencotter (1995) saying that peer review encourages critical examination, promotes the exchange of ideas and guides academic discourse.

Some other reflections referred to the students' feelings about their own performance, both as reviewers and being reviewed

"In the workshop, we understood the importance of working as a team. It was demonstrated, for example in the presentation which was built of several (non-integrated) parts. I personally, learned many things, especially from what my team members did as well as other students in the document they prepared (and which we evaluated)."

"I've learnt a lot from analyzing other student documents"

"The first document we produced was not good enough. We understood it from the comments we received as well as from evaluating the document we got. Based on these comments, we managed to improve the other documents we produced"

These reflections demonstrate the students understanding that acting as reviewers helped them. It is not clear, however, how this help materialized, besides the fact that the reviews exposed the students to a variety of available solutions, which also helped them improve their own solution. These findings are consistent with Longhurst & Norton (1997) and Dochy et al. (1999) in that peer assessment have been found to enhance learning outcomes and to help students improve their own learning. We intend to further check how the workshop affects the soft skills of the students by examining their performances during the bi-semester final project.

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Appendix I. template example (initiation and planning document)

This is an example of the template documents used in class. These are simple Word files with a list of paragraphs to be addressed by the students. The templates serve only as general guidelines. The students have to consider each paragraph for its relevance to their particular story. It is expected that students will include in their document additional needed paragraphs, which are missing in the template.

1.1.1 The Max Stern Academic College of Emek Yezreel

Computer Science and Information Systems Department

--- TEMPLATE ---

Initiation and Planning Document

1. Executive Summary
2. Current System Description
3. Problems with the existing system
4. Preliminary requirements
   - 4.1. New system objectives
   - 4.2. New system potential benefits
5. Feasibility Study
   - 5.1. Technical feasibility
   - 5.2. Economic feasibility
   - 5.3. Organizational feasibility
6. Preliminary project plan and staffing
7. Project borders
8. Required standards
9. Preliminary Risk Analysis
10. Recommendations

Figure 4. Initiation and Planning Document Template

Appendix II. Guidelines example

This is an example of the guidelines documents used in class. The guidelines documents are based on Excel worksheets. The students fill the worksheet and submit it electronically. The worksheet is locked and only relevant fields are available for the students (the shaded fields). The total grade is calculated automatically.

Guidelines for evaluating and grading analysis documents

Course:	
Evaluating Team:	
Owner Team:	
Team Members:	

Please grade all paragraphs.
Only the designated cells can be modified

	Part A Paragraph	Grade	Max Grade	Reason for the grade
	Changes to			
1	Previous doc.		4	
2	Executive Summary		8	
	Requirements			
3	Strategy		4	
4.1	Req. Plan Review		3	
	Interviews			
4.2	Description		2	
4.3	Relevant Questions		2	
	Interview			
4.4	Transcription		1	
4.5	Questionnaire		2	
4.6	Special Diagnosis		1	
4.7	Other		1	
	Current System			
5.1	Review		3	
5.2.1	Current UC Review		2	
	Current UC			
5.2.2	Description		2	
	Current UC			
5.2.3	Diagrams		2	
	Current Process			
5.3	Model		4	
	Current Data			
5.4	Model		4	
	New System			
6.1	Review		4	
6.2.1	New UC Review		5	
	New UC			
6.2.2	Description		5	
6.2.3	New UC Diagrams		5	
6.3	New Process Model		8	
6.4	New Data Model		8	
	Part B			
1	Clear Readable		12	

	Wording			
2	Layout and Design		8	
	Total	**0**	**100**	

Figure 5. Analysis Document Grading Guidelines