THE GAP BETWEEN INTENTION AND ATTAINMENT IN POLICY IMPLEMENTATION: A SYNDROME REVISITED. THE CASE OF THE REFORM IN TECHNOLOGICAL STUDIES IN ISRAEL

IRIS GEVA-MAY
ISAAC LEVIN

Abstract – *This study analyses the syndrome inherent in the gap between policy setting and policy implementation, as exemplified by the case of the reform in the high-school system initiated by the Israeli Ministry of Education's Technological Division. The reform policy in the Technological trend prompted by the great advances in this field in recent years is explored, and the degree of its expected versus de facto implementation is analysed. The measurement tool for degree of implementation is the comparative requirements of the final matriculation exams before and after the beginning of the reform. The analysis focuses on the electronics and electricity trends. It challenges the validity of the proposed reform implementation and disputes the validity of the matriculation exams as a tool meant to assess reform implementation. The gap between the initial intention of the policy makers and actual policy implementation will be analysed and discussed.*

Introduction

This study refers to the reform policy initiated in Israel by the Ministry of Education in high-school electricity and electronics trends following the great technological developments of recent years. Microelectronics, speed of data processing, space and medical electronic instruments, digital communication – have all developed and markedly influenced our lives over the last fifty years. The need to update school curricula in the field of electronics has therefore become imperative.

This reform initiative was taken by the Ministry of Education in the late 1980s and its actual implementation began only in 1989/1990. The goals of the reform, as stated, were the following:

a) to endow the high-school student with a broad basis of technical and scientific knowledge, with the additional purpose of easing his/her difficulties when joining an institution of higher education or industry;

b) to strengthen individualised learning beyond regular school hours;
c) to neutralise the stigma connected to status within technological studies, i.e., 'superior' for electronics and 'inferior' for mechanics;
d) to give the student the opportunity to perform in the matriculation exams according to his/her ability and desire;
e) to increase computer-learning time;
f) to enable the student to shift from one level of learning to another within a certain subject-trend.

The reform process in the technological trend started in 1989 and involved ten pilot high-schools across the country. These schools instituted the post-reform matriculation exams in 1990. Gradually, more technological schools joined the reform. In the following years all technological high schools applied the same type of matriculation exams, except for the lower levels where the reform implementation started only in 1993. The new subject-matter and the cognitive approach advocated by the reform were supposed to be present in these new tests.

This study is mainly concerned with the implementation of the first and second goals. The basis of analysis is the content matter of the matriculation exams. The rationale for using these exams as an indicator for degree of reform implementation is that these tests, in Israel, reflect the final subject-matter knowledge, mastery and cognitive development that high-school students reach. The content of the matriculation exams reflects the requirements demanded of the students at the end of their learning process. Therefore, in our context the student is presumed to have acquired the body of knowledge set by the reform goals and to be able to perform adequately when tested on it.

Theoretical background

It is well known that implementation is a complex task in which a variety of obstacles may interfere. Basically, implementation implies the carrying out of political decisions. Such decisions will have identified a problem, will have set the goals that should be aimed for, and will have built up the process of implementation. In Majone and Wildavsky's (1984) view implementation is an execution process and a realisation of schemes and conceptions. Lingard (1992) addresses the broader economic, social, political and ideological context (of educational reform implementation in Australia) that affect execution processes and realisation of schemes and conceptions.

Nevertheless, in this respect models such as those presented by Bardach (1977), Edwards and Sharkansky (1978), Hogwood and Gunn (1984), Pressman

and Wildavsky (1984), Levine and Ferman (1985), Alexander (1989), Geva-May (1993, 1995) and in the field of education, among others, Bob Lingard and Linda Apelt (1993) and Bob Lingard (1991) in Australia and Stephen Ball (1992a, 1992b) in the UK, do not offer a very optimistic view of the situation in real-world circumstances. Levine and Sanger (1994) believe that if policy objectives set the goals of an administration, then in order for it to be implemented, its implementation problems must be anticipated beforehand. As they point out, it is ironic, for instance, that while billions are spent on discovering an AIDS vaccine, management obstacles can subvert a quick and effective immunisation program. It is ironic, in the case presented in this study, that when scientific and technological advancements have become so crucial throughout the world as we approach the end of this century, pitfalls in implementation derail a much needed reform policy. The long-term disadvantage and its effects are easy to figure out.

True, the implementation process is recognised as difficult to execute; the gap between policy setting and attainment is usually generated at this stage. The factors affecting implementation may be the result of contests among various actors, organisational structures, limitations – whether functional or financial, and feasibility.

In part, one main factor at the organisational level is the various organisational loci where policy decisions are made and policy implementation takes place. Lynn (1987) observes that 'decisions and actions (are) taken at all levels: high, middle and low' and therefore those who are concerned with policy making might be limited in their decisions and actions by 'games at all levels... above, beside and below them.' In general, in organisations implementation is viewed as 'mosaic' (Nakamura, 1987) and is part of the interplay between strategic considerations and bureaucratic routine. Even though termination might be decided upon at top-level management, or felt necessary at the low or middle level, it can be derailed on the other executive levels by low or middle policies or by the very same bureaucratic routine. Ultimately, the actors involved at each locus, and their interests, or lack of interest, are those who promote or derail any policy implementation attempt (Bardach, 1976; May and Wildavsky, 1978; Thompson, 1984; Ball 1992a.; Lingard 1992; Geva-May, 1993, 1995). Vested interests may prove to be a seemingly immovable obstacle to implementation of otherwise well-reasoned policies. Ball (1992a.), for instance, suggests that the implementation of the national curriculum for England and Wales has been a dialectical process influenced by legislators, administration and teachers.

Moreover, while technological knowledge and developments advance at an incredible speed, organisations, decision making and decision makers' approaches have the tendency, by their very nature, to remain stable, conservative and unchanged (Dror, 1971).

In view of these interfering factors, a key consideration should be how to overcome the gap between the realistically feasible and the optimal. While policy planners seek to set the optimum, those concerned with implementation should decide on the feasible.

For instance, before proposing an implementation process one should diagnose the general professional or organisational culture context, the actors involved and their values, beliefs, assumptions and behavioral norms. Anticipation of possible resistance should allow for better chances of implementation (Lynn, 1980; Levine and Sanger, 1994). For instance, Lynn views the capacity and performance of an organisation as the separate and combined effects of its technology, tasks, structure, financial resources, human resources, culture and environment. These need to be taken into account, separately and combined, to secure adoption and successful implementation. Levine and Sanger view culture as assumptions, values and behavioral norms.

The implementing team should be briefed as to the 'next steps' they have to take in order to act on the policy recommendations. Technical assistance programs, information exchanges and human resource training programs are typical of such 'capacity building' strategies.

Co-optation, as far as is possible, assigning implementation responsibility to an entity truly supportive of the policy, and employing 'fixers' to oversee the implementation process and encourage unwilling implementers to do their job, are recommended tactics for implementation. Bardach uses the term 'fixer' to describe an individual who oversees the day-to-day operational process of translating policy into action, audits or uses incentives for co-operation, provides valuable feedback to implementers and policy drafters alike on what befalls the policy as it is implemented in the field (Bardach, 1977; Levine and Ferman, 1985; Weimer and Vining, 1989; Levine and Sanger, 1994).

Weimer and Vining (1989) propose a technique called 'forward mapping' to help flesh out implicit assumptions about the implementation of a policy and improve the policy's chance of success. In forward mapping, you try to predict what must transpire for the policy to have its intended effect, including 'what' could go wrong, and 'who' might want it to go wrong and 'why'. Elmore details means of avoiding pitfalls in implementation and advises to begin with a concrete statement of the behavior that creates the occasion for policy intervention; to describe a set of organisational operations that can be expected to affect that behavior; to describe the expected effect of those operations; and then to describe what effect might be expected at each of the implementation levels on the target behavior, and what resources are required for that effect to occur (Elmore, 1979; May, 1986; Weimer and Vining, 1989; Levine and Ferman, 1994).

In curricular policy implementation obstacles are mainly attributed either to experienced teachers' previous teaching habits or to the character of the school principal and other professional leaders. Some of these individuals are those who eventually set the tone and write the matriculation exams. Ball (1992), examining the factors influencing changes in the English instruction since 1900, suggests that teachers' acceptance of an educational paradigm heavily depends on previous teaching experiences, loyalties generated during training, and support from their professional network. Hallinger, Hausman and Murphy (1992) found that even professional principals/leaders who view themselves as supporters of a fundamental reform are often severely limited by their own beliefs, training and experience in implementing reforms. As a result, although new detailed teaching guidelines are given, final performance requirements do not necessarily reflect the curricular changes just initiated.

Furthermore, if target assessment requirements do not change, i.e., the matriculation exams' content and demands, content-matter taught and methodological approaches remain unaltered. It is an accepted axiom in curriculum, assessment and evaluation literature that there should be a correlation among the three, and that they should all start from the same common goal-oriented denominator. When the connecting design among the three is poor, the goals cannot be attained.

The study

Study design

At the basis of our study stands the threefold conceptualisation of the relationship among aims implementation, assessment and evaluation, which goes as far as Tyler's (1950). Tyler's evaluation model refers to the assessment of aims' attainment as compared with policy's aims – at the end of an implementation process in order to find out how successful the program/policy has been. Haywood (1989), and Carter et al. (1986) discuss this issue in relation to science subjects. Like Tyler (1950), Schwab (1964) and others, Haywood stresses the fact that for each general curricular objective there should be an appropriate method of testing in order to check whether an objective has been attained or not. In turn, we claim that if the same objectives mark all three – the curriculum content, the assessment, and the evaluation, as the literature suggests – then any final proposed assessment should reflect those goals and their related content. Moreover, at the implementation stage in education, students should be helped to grasp the structure of the field of study, so that as a result they will be able to apply the

principles and experiences learned in a variety of situations (Bruner, 1963; Haywood, 1989). If all the above is true, the matriculation exams should present the same type of activities as those requested by the reform/curricular objectives, and should check students' ability to apply what they have learned.

In this study, we challenge the implementation of the reform policy goals (its curricular and methodological expressions) on grounds of content and face validity. Our main tool of inquiry is the discourse analysis of the matriculation exams – before and after the reform. The comparative methodology through pre- and post-analysis should throw light on whether any changes occurred after the reform was supposedly put into practice, and if the reform had any impact at all.

Content validity should provide answers as to the extent to which the goals and the test content reflect on one another, or in Haywood's words, the extent to which the exam represents the universe of related content; at the level of face validity we investigate the extent to which an exam actually shows that it measures the variables it is intended to test. We are not interested in predictive, concurrent or construct validity, because actual present or future performance in these exams is not under study.

Thus, the main goal of this study is to find out whether and to what extent the content and the analytical level of the questions set in the matriculation exams reflect the goals and frameworks defined by the reform. The subject matter and the pedagogical approach adopted in these tests are supposed to reflect the new educational policy and its level of implementation. The test of these exams' validity lies in their relation to the policy's objectives and point to degrees of policy implementation success. Therefore, we looked for changes between the pre-reform and post-reform exams.

Research method

The research method adopted is comparative and observes requirement differences – if they exist – between pre- and post-reform matriculation exams in the technological trend. A sample of pre- and post-matriculation electronics and electricity exams are analysed in order to identify the implementation of the target objectives of the reform policy. The content analysis of these exams follows principles set by Kerlinger (1973) who asserts that content analysis is not only a method of analysis but also one of observation. The investigator examines the materials produced, in this case the matriculation exams, and devises different observation measurements, in this case fourteen observation questions. The first step, according to Kerlinger, is to define the universe of content being dealt with, which in this study is the matriculation questions given to high-school students in the field of electricity. The second step is to divide that universe into categories.

Such categorisation, as followed in this study (see tables 1 and 2), points to the different units of content we wish to analyse.

By its nature the evaluation undertaken in this study is summative (Scriven, 1977; Nevo, 1983; Leithwood, 1986), pursues a basically Tylerian goals-versus-outcomes approach (Tyler, 1950), and leans on the problem-solving taxonomy criteria typical to the field of electricity (Waks and Lindenlaub, 1981).

According to Scriven, summative evaluation is a process at the end of which one can answer questions such as:

a) What is the degree of success of a certain new instructional instrument against an acceptable criterion?
b) Has success improved compared with the situation before the change?
c) What are the advantages of the reform?
d) Are the various investments in the reform 'cost efficient' in view of the degree of benefit given by the new instrument?

A common objective when evaluating an object – in this case a reform policy – is to judge its worth and benefit. Therefore, the content analysis conducted in this study seeks to find out whether the reform policy guidelines have led to any changes – whether at the content-matter level, in the relationship between content and previous knowledge, and so on. As such, the analysis focuses on:

a) the subject to which the matriculation exam questions refer;
b) the standard against which the exam problems were designed;
c) the value of the test, i.e., the goals that had to be met by the exams;
d) the source, i.e., who produced the questions and where;
e) the time, i.e., the length of time allocated to solving a problem;
f) the conflict existing between the syllabus and the exam in terms of content and level;
g) the cognitive level the exam was aimed at.

The criteria chosen in this analysis for the cognitive level, accord with the PST – Problem Solving Taxonomy. This taxonomy is viewed as most appropriate for evaluating technological tests of various levels. The PST rests on Bloom's (1956) taxonomy, and was developed by Dean and Plants (1978). Waks and Lindenlaub (1981) elaborated on the cognitive levels of problem solving in the domain of electricity.

According to this taxonomy there are five distinctions of problem-solving complexity:

a) routine is the lowest and it is achieved when a student solves a problem according to a certain routine he is familiar with;

b) diagnosis is the second level of complexity and refers to the condition where the student chooses the correct solution among a number of possibilities that seem proper but some of which are incorrect;

c) strategy is the third difficulty level in this taxonomy, meaning that a student is capable of selecting the most convenient solution among several possible ones.

d) interpretation is the stage when one is capable of solving a problem with the aid of simulation and can translate the solution from the simulation world back to the real world.

e) creativity is the highest taxonomic degree and refers to the level a student reaches when s/he is able to find an original solution to the question to be solved.

For our analysis, we translated these summative and the taxonomic components into a 14-step analysis criterion (see tables 1 and 2), which included:

- *the declared objectives of the syllabus* (1), as periodically published by the Ministry of Education;
- *the declared main subjects of the reform syllabus* (2), in this case as prescribed for the 10th to the 12th grades in electricity and electronics;
- a*ccordance of the exam with the content matter set by the syllabus* (3), i.e., whether the declared subjects appear in the exams;
- *accordance with syllabus objectives* (4), i.e., whether the declared learning tasks appear in the exams;
- *ratio between the number of questions in the test and the study-time allotted to a particular subject* in the syllabus (5);
- *PST level* (6), i.e., the taxonomic level required of the students in the exams – at the routine, diagnosis, strategy, interpretation, or creativity level.
- *degree of science interlacing* (7), i.e., to what extent the exams reflect the requirement for a deep understanding of science beyond the regular use of equations and formulas;
- *knowledge variability* (8), i.e., the number of different subjects in a certain exam;
- *deep and sound knowledge requirements* (9), i.e., to what extent the students need to have acquired deep and broad knowledge in order to answer the exam questions;

- *content redundancy* (10), i.e., whether similar exam questions appear year after year;
- *degree of question choice in the exam* (11), i.e., the number of questions to be answered from a set given in a test; this points at the degree of difficulty of the test;
- *time allocation* (12), i.e., time allocated in the exam to students to solve each question;
- *proficiency delay* (13), i.e., whether the professional training proficiency has indeed been postponed until the very final period of high-school, as opposed to the pre-reform approach where professional training was undertaken and already tested in the earlier years of school;
- *trend overlapping* (14), i.e., the degree of content similarity and complemen-tation between the electricity and the electronics exams.

Data collection

The data collection and its analysis concentrate on the characteristics of the matriculation exams before and after the reform in order to identify whether any significant content or conceptual changes occurred. Any such changes, in this study, would identify to what extent the reform influenced attainment expectations, how these expectations were reflected in the matriculation exams, hence whether the reform had actually been implemented. In other words, they would attest as to whether there was any gap between the new policy and the reality in the field.

Two major sample exams, one from the electronics trend and one from the electricity trend, were analysed following the above 14-step criterion. For comparison purposes the study included 7 pre-reform tests given in these subjects in 1987, 1988 and 1989, and 6 post reform tests at two points of time: one at the end of the first year of the reform in 1990, and the other two years later in 1993, when the reform was considered to be well on its way. The two post-reform points of time would also allow more valid conclusions to be drawn from the results obtained.

The exams were chosen so as to cover the same field of knowledge and related professional programs – in terms of general content definition – before and after the reform. The specific topics looked into were mainly digital electronics, analog electronics, measurements and communication. Note that the study concentrates on levels A and B, which are considered the highest study levels in the electricity and electronics trends in Israeli technological schools.

Pre- and post-reform matriculation exams analysis

The syllabus underlying the pre-reform exams was published in 1983. The reform syllabus was actually an expansion of the 1983 syllabus. The core subject-matter and the structure of knowledge in electronics and electricity remained the same.

Pre-reform exams analysis

The general educational objectives of the pre-reform electronics syllabus set until 1983 were:

- providing the students with sound and broad knowledge in microprocessors software and hardware;
- interlacing, in classroom lessons, modern communication concepts;
- teaching high-level computer languages;
- improving the ability of individualized thinking;
- dividing the learning process into analog and digital electronics.

The general objectives of the electricity syllabus were:

- to deepen and broaden the basic concepts of the profession, and by so doing to enable the student to merge quickly and easily in the technological world;
- to increase individual working and learning abilities;
- to develop the skill of reading and understanding data sheets and technical reports of various manufacturers in the electricity field.

Under the above general objectives there were included hundreds of subjects, covering, in electronics: semiconductors, electron movement in a vacuum, operational amplifiers, CRT, logic gates, wave propagation, microprocessors, television, and more. The electricity syllabus included subjects such as fundamentals of electricity and networks, switching and control, electrical systems, energy conversion, etc.

In spite of the very long and detailed lists of learning items, an analysis of the exams set over a period of three years shows that many important sections included in the syllabus were not tested even once in the 1987, 1988 and 1989 matriculation exams, e.g., power amplifiers, network theory, CRT, antennas, television, and wave propagation. Even subjects relating to popular items in our everyday life, such as stereophonic communication or color television, were omitted. On the other hand, typical identical subjects such as operational amplifiers and the technology of electronic components, appeared every year.

The 1987-1989 matriculation exams in both electricity and electronics were found not to have included questions that could reflect on the acquisition of a real and profound understanding of the structure of knowledge. Approximately 90% of the problems presented were routine questions according to the PST. This implies that in the pre-reform era, routine study of items from the syllabus could guarantee the student sufficient success in the final exams, and that s/he was not expected to master more than that.

The following table presents, separately, a detailed analysis of the 1987-1989 tests in electricity and in electronics according to the 14-step content analysis criterion designed for this study.

Post-reform exam analysis

The second part of this study concentrates on the matriculation exams formulated at the end of the first year of the reform, in 1990, and three years later, in 1993. The three years time gap was considered to allow for expected policy adoption patterns and teaching/learning changes.

As previously noted, the aims of the reform were:

a) to endow the high-school student with a broad basis of technical and scientific knowledge, with the additional purpose of easing his/her difficulties when joining a university or industry;
b) to strengthen individualised learning beyond regular school hours;
c) to neutralise the stigma connected to status within technological studies, i.e., 'superior' for electronics and 'inferior' for mechanics;
d) to give the student the opportunity to perform in the matriculation exams according to his/her ability and desire;
e) to increase computer learning time;
f) to enable the student to shift from one level of learning to another within a certain subject-trend.

In keeping with the reform policy, school electricity and electronics trends were unified and the syllabuses were merged. At the content-analysis level no noticeable differences between the pre- and post-reform matriculation exams were found. If matriculation exams are the ultimate final expression of knowledge, mastery, skill and cognitive development, then it was found that at these levels the post-reform exams did not demand, or expect, different ways of learning and thinking. Both the content and the face validity of the matriculation exams were found to be very low, not reflecting the initial goals of the reform in this trend of technology. Thus, the actual implementation of the reform policy was found

TABLE 1: Analysis of Sample Pre-Reform Matriculation Exams (1987-1989)

14-step analysis criteria	*Professional Trend*	
	Electricity # 301 Tests # 330251, 330141, 330041, 330261, 330061	**Electronics** # 304 Tests # 340061, 340161
1. declared goals of pre-reform syllabus	a. deepening the basis of knowledge and thus allowing for quick adaptation to the future technological world. b. increasing experimental work (labs). c. developing students' ability to read and understand application notes and manufacturers' reports.	a. transfer of broad and profound microprocessor knowledge -- software and hardware. b. introducing modern communications systems, digital and fiberoptic techniques. c. teaching high-level computer language.
2. main subjects in the syllabus	a. theory of electricity b. switching and control c. electrical systems d. energy conversion	a. theory of electricity -- basics b. analog electronics c. digital electronics d. introduction to computers e. communication fundamentals f. components technology
3. accord with syllabus content	full accord in 7 sample exams (59 problems)	full accord in 6 sample exams (60 problems)
4. accord with syllabus objectives	first objective: 10% second objective: 0% third objective: 100%	first objective: 50% second objective: 80% third objective: 80% fourth objective: 5% fifth objective: 100%
5. correlation (no. o problems and tim allocated to relate topic teaching)	moderate: about 35%	small: about 15%
6. PST level	routine: 100%	routine: 90% strategy: 10%
7. science intertwining	not existent	not existent
8. knowledge variability	existent -- 100%	existent -- 100%
9. deep and sound knowledge	minimal -- about 5%	minimal -- about 5%
10. redundancy of topics in exams	complete	complete
11. choice rate	usually 5 out of 9	1 out of 2; or 2 out of 3
12. time allocation per problem-solving in exams	30 minutes per problem	30 to 60 minutes per problem
13. delay of proficiency	existent -- about 20%	existent -- about 20%
14. overlapping electronics/electricity	existent -- about 25%	existent -- about 25%

lacking: at the end of the first year of reform implementation, no major content-matter changes or different achievement requirements were found. Nor were any substantial changes identified three years later, in 1993 (see table 2).

In fact, paradoxically, the reform syllabus offers very detailed components. In addition, two types of 'test tasks' are proposed. These test tasks should guide the teacher and the student on specific tasks that may be presented in the exams. The first type of task, named 'nucleus task', indicates knowledge of items in the program. Beside each noted task there is a serial number that designates the subject/item in the syllabus. A second task, named 'composed task,' indicates knowledge of interrelated subjects in the syllabus. Here is a sample list of such proposed tasks from the various fields of electronics/electricity:

- analog electronics - to find the amplitude of periodic wave; to define output resistance of an amplifier.
- digital electronics - to convert a number from base 16 to base 2; to explain the principle of operation of synchronous counter.
- computers and microprocessor - to use the command 'diskcopy'; to explain the functions of a modem in a communications system.

To study the first years of reform implementation and goals attainment, a sample of three exams - electricity, energy conversion and control, switching and digital systems - was investigated. The 1993 tests included electronic systems, electronics and computers, energy conversion and control. No obvious difference between the characteristics of the 1990 and the 1993 tests was identified, even though the detailed requirements of the syllabus led one to envisage much higher levels of performance expectations in the later post-reform matriculation tests. An analysis of findings, following the 14 step criterion, is presented in table 2 below.

In the first post-reform year, the test questions covered 60 percent of the subjects that were supposed to have been taught. Nevertheless, both in 1990 and in 1993 the questions basically remained at the routine level. Main aims of the reform, such as science interlacing with technology, or transfer of deep and broad knowledge, were not seen to be expressed in these tests. For example, in the 1993 matriculation test paper no. #841201 in Electronic Systems, the student was asked to solve various problems such as: 'explain the 'three state' logic and its use'; 'explain the concept 'open collector' in logic components'; 'draw a block diagram of an FM superheterodyne receiver. Explain the function of each block.'

In view of the above findings, the additional goal of the reform, namely educating students so as to provide them with the option of selecting their own technological path in the future, cannot possibly be attained if the highest level of required performance is merely routine.

TABLE 2: Analysis of Sample Post-Reform Matriculation Exams (1990-1993)

14-step analysis criteria	*Unified Professional Trend*	
	Electricity # 301 Tests #111222, 111331	**Electronics** # 304 Tests # 815101, 815102, 841201, 111223
1. declared goals of pre-reform syllabus	a. to give each student the opportunity to express individual ability; b. to update content-matter and skills in technological education to match future technological advance; c. to broaden the scientific basis of technological education; d. to increase individualized learning; e. to allow taking matriculation exams according to individual choice and ability;	
	f. operational tasks not existent in 1990;	f. operational task exists: e.g. to define BCD code; to explain shift registers.
2. main subjects in the syllabus	a. switching and digital systems; b. analog electronics; c. digital electronics; d. electronic systems -- measurements, communication.	
3. accord with syllabus content	full accord	full accord
4. accord with syllabus objectives	the objectives were not specified for all the topics; when specified -- appeared in the exams, e.g., for "switching and digital systems" the stated objective was "understanding principles and developing problem-solving skills."	full accord with stated tasks but not with the general objectives of the syllabus, e.g., the concept "zone of proximity" is not touched on by any of the matriculation problems in the sample exams.
5. correlation (no. of problems and time allocated to related topic teaching)	limited	limited
6. PST level	routine: 100%	routine: 95% diagnosis: 5%
7. science intertwining	not existent	not existent
8. knowledge variability	existent -- 100%	existent -- 100%
9. deep and sound knowledge	minimal	minimal
10. redundancy of topics in exams	irrelevant criteria in the first year of post-reform exams.	good -- about 80%
11. choice rate	5 problems out of 9; or 4 out of 7	
12. time allocation per problem-solving in exams	30 to 48 minutes per problem	30 to 36 minutes per problem
13. delay of proficiency	existent -- 100%	existent -- 100%
14. overlapping	unified trend	

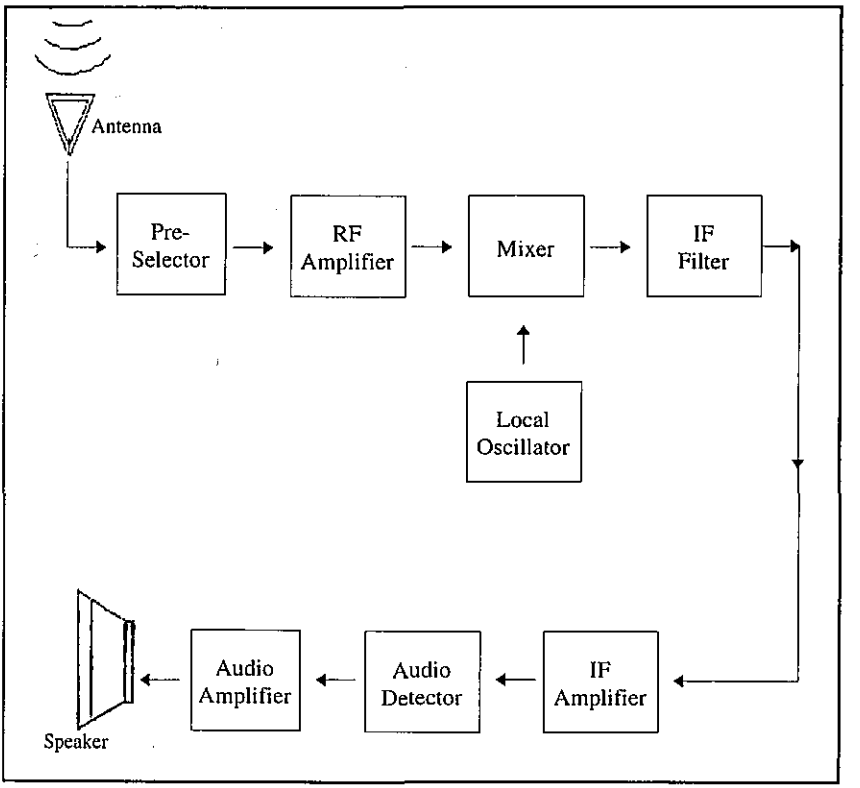
Sample questions from pre- and post-reform matriculation exams

The following are sample random questions from the pre- and post-matriculation exams analysed in this study:

A. Before the reform - test paper no. #340061:

'Explain the operation of the system shown in the following figure and state its function. What is the purpose of each building block of this system?'

FIGURE 1



If we refer to the fourteen-step analysis criterion, the conclusions we are bound to reach are similar to those reached in table 1 for the pre-reform exams:

1. The introduction of a modern communications system is not reflected: the system shown is in fact an AM radio invented about 60 years ago. In addition, the objective of tutoring toward self-thinking cannot be assessed when the student is asked to describe a block diagram of a radio system.
2. Communications fundamentals – this is indeed tested by this type of problem.
3. The problem accords with the content-matter required by the syllabus.
4. The problem does not accord with syllabus objectives.
5. The relationship between the number of questions and time allocation for teaching radio systems is weak. The time allocated for the learning of radio systems was 2 yearly hours that were part of 40 yearly hours devoted to the field of communication.
6. The PST level is 'routine.' Hereby average memory is needed by the student to receive a full score for his/her complete answer.
7. Science interlacing is not touched on at all in a description of the radio required here.
8. Knowledge variability cannot be relevant when only one problem is presented.
9. Deep and sound knowledge is not required in this case in order to answer correctly.
10. Redundancy: a similar question appears in every matriculation exam.
11. The rate of choice in this case is one problem out of three.
12. Average solution time per each single problem was 36 minutes.
13. Delay of proficiency is not relevant in this case.
14. Overlapping is not relevant in this case.

B. After the reform - test paper no. #841201:

'Draw a block diagram of an FM superheterodyne receiver. Explain in detail the function of each building block.

Specify the considerations leading to choosing the intermediate frequency of that receiver.'

Referring to our 14-step analysis criterion we may conclude that, as table 2 shows, the reform policy does not seem to have affected the level or type of final performance requirements:

1. None of the declared objectives is reflected in such a problem-solving requirement, i.e., such a problem presentation concerning an FM receiver has nothing to do with 'broadening the scientific basis

of technological education,' and has no relation to 'increas(ing) individualised learning.'

2. The subject, a superheterodyne receiver is indeed an important topic that must be included in an electronics matriculation exam.
3. Accordance of the problem with the content required by the syllabus is found. The subject covers the topics presented in the syllabus as regards communications.
4. Accordance of the problem with syllabus objectives is found, i.e., the type of answer elicited by the sample problems above, does not stimulate any cognitive effort.
5. The correlation between the number of problems in the exam and the time allocated to teaching receivers was found to be adequate.
6. The PST level is obviously routine, since no complex level of thinking is needed to solve the problem. Remembering what has been said in class is enough to obtain a full score.
7. Science interlacing is not reflected at all in the problems.
8. Knowledge variability is shown to some extent since the principles of operation of the various building blocks of a receiver are different, in a sense, although they all belong to the communications field.
9. Deep and sound knowledge is not reflected, and is not needed in fact, at the level required by this problem.
10. Redundancy of some subjects in exams: this exists.
11. Rate of choice in the exam: one out of six. This is an unreasonably high choice rate.
12. Average time per problem: 36 minutes.
13. Delay of proficiency is not relevant in this case.
14. Overlapping is not relevant in this case.

To sum up the conclusions reached in this analysis, we find that the cognitive level required for the tasks of the post-reform exams did not change in comparison with the pre-reform demands. In both cases our content analysis pointed at 'routine,' or in Bloom's terms, 'knowledge' levels. In the examples shown above, in the pre-reform exam the student was asked to explain the given block diagram of a common receiver. In the post-reform era s/he was asked to draw that receiver and explain its components. In both cases, only her/his ability to memorise was assessed and nothing more. The only difference we could see – and not for the best – was that before the reform the student had to choose one question out of three, while after the reforms s/he had much more freedom and could choose one question out of six! S/he did not have to know too much!

Summary and discussion

The comparative content-analysis undertaken in this evaluation study identified the following:

- There are no major differences between the pre- and post-reform questions in the matriculation exams, in terms of content matter, state of the art, or level of cognitive expectations.

- The highest taxonomy level in the studied post-reform sample tests is diagnosis – which falls far short of the syllabus's intention.

- Those who write matriculation exams are usually experienced senior teachers, who express the state of the field. The loci where the outcome of the reform is decided are on the low and middle levels, by teachers and their supervisors. Also, as pointed out in the introduction, one of the main factors in the implementation of any reform policy is the actors, their motivations, interests, and professional culture. The difficulty teachers have in changing their teaching habits is a major impediment in reform implementation. Only few act on the curriculum, inquire about it and elaborate on it. Others use the new program as prescribed, or use well-mastered old methodology, without any personal input into the new approach (Connelly and Clandinin, 1987; Ball, 1992b.). In the case of the post-reform exams, it is likely that the reform syllabus, although officially adopted, has been taught with the same good old methodology. The low and middle levels, and their lack of interest in changing habits, prove to be the determining factors in the implementation of this policy. The expectations reflected in the matriculation test papers, point in this direction.

- At high-school level, the matriculation exams can serve as the only main driving force for reform implementation. They can raise learning standards through the topics covered, through their complexity, or through a cognitive level enhanced by the problems touched on. On the other hand, matriculation exams similar to those in the pre-reform era will only set the clock back through lack of expectations.

- In general, the findings of this study, conducted three years after the beginning of the reform implementation, show at post-reform matriculation exams similar to the pre-reform exams. The post-reform exams showed very low content and face validity, i.e., they did not match either the approach or the

level set by the reform syllabus, and indicated that the objectives of this reform policy have not been attained; or rather, that in the 'lower and middle' loci there was no reform policy achievement expectation.

The reform policy was the right step to take in view of the developments inherent in the field of electronics and electricity: new approaches and contents must be adopted if the educational system wishes to prepare students for the degree of knowledge and competence required in technology in present time. Neither the needs of the times we live in, nor the reform policy objectives meant to meet these needs, one reflected in these exams. As Dror (1971) contends, approaches to implementation in organisational structures lag behind the swiftly changing technological needs. Both at the content and at the face validity level the post-reform exams proved to be holding on to the old procedures – which may mean that teachers still have very low expectations of their students. No commonality of view and purpose – as posited by Carter, Haywood, and Kelly (1986) – was identified in this study. It seems that the teachers were content to go on with the good old approach, and the students couldn't care less. Broader views underlying education and teacher education and including education to competent practice, and development of human capital for national investment, depend after all on competent practitioner development (Knight, Lingard and Barlett, 1994) or in other words, on teachers' willingness to adopt new performance guidelines.

The findings of this study raise several key questions: Does the gap between the explicit guidelines set by the new policy in the technological trend and the exam assessment criteria represent lack of success in the implementation of the reform? Does it mean that the laissez-faire attitude of the teachers in the field has put an end to it? Does it imply that leadership strategies, for implementation purposes, have not been attended to? Hence, do the matriculation exams, as they are at the post-reform stage, point to the beautiful rise and abrupt fall of the reform in the technological trend? Since the evaluation undertaken in this study was by definition summative, i.e., seeking final data at the end of an implementation process, and Tylerian, i.e., attempting to find out whether the goals of a policy/program have been attained at the end of the implementation process, we cannot provide formative-causal answers. A formative evaluation involving interviews with technology teachers, school principals and students, as well as classroom observation sessions, should expand on and validate the findings obtained in this study.

The data gathered in this study three years after the start of the actual reform implementation, lead to the following conclusion: there is no doubt about the good intentions of the policy makers regarding the target content and the pedagogical issues that could foster advanced knowledge and skills in technology. Yet the final

expectations as presented in the matriculation exams – and which set the standard for the learning/teaching process – point to low validity, i.e., to a serious gap between intent and goals achievement in the implementation of this reform. Unfortunately, the well-known syndrome, the implementation/policy-setting gap, has been detected once again. The findings reinforce assumptions raised in the field regarding policy implementation. In this case, no matter how acute the problem may be, or how important the policy is, devising a clever policy is not enough: steps have to be taken to make for implementation.

To sum up, the main pitfalls in policy implementation are usually the by-product of overlooking the fact that policies are determined by power contests, and that goals cannot be set independently of the means to obtain them, the loci, the actors and the culture involved. Policy makers sometimes misjudge the complexity of problem-solving in the practical world of affairs, as against 'laboratory' forecasting. They tend to neglect to note elusive uncertainties and to apply one of the many steps available to cope with them. This can give poor results which, in turn, may create new problems during implementation. Unless policy makers begin to envisage problems that might be encountered at the implementation stage, a policy's robustness is in trouble (Geva-May with Wildavsky, 1997). Robustness in this context is assessed by the ability of a policy to succeed in different environments and to survive in face of a difficult implementation process.

Iris Geva-May *teaches in the Department of Political Science, University of Haifa Haifa 31905, Israel. Tel: 972-4-8253940; 8249096; Fax: 972-4-8257785; email: gevamay@poli.haifa.ac.il*

Isaac Levin *teaches at the ORT Academic College for Teachers in Technology Jerusalem, 95435, Israel.*

References

Literature

Alexander, E.R. (1989) Improbable implementation: The Pressman-Wildavsky paradox revisited. *Journal of Public Policy*, Vol.9, 451-465.

Apelt, L. and Lingard, B. (1993) Public schooling in Australia: In whose interest? *Journal of Educational Administration*, Vol.31(3), 59-71.

Ball, S. J. (1992a.) Subject departments and the 'implementation' of National Curriculum policy. An overview of the issues. *Journal of Curriculum Studies*, Vol.24, 2, 97-115.

Ball, S. J. (1992b.) Competition and conflict in the teaching of English: A socio-historical analysis. *Journal of Curriculum Studies*, Vol.14(1), 1-28.

Bardach, E. (1974) Gathering data for policy research. *Urban Analysis*, Vol.2, 117-144.

Bardach, E. (1976) Policy termination as a political process. *Policy Sciences*, Vol.7(2), 123-131.

Bardach, E. (1977) *The Implementation Game: What Happens After a Bill Becomes a Law*. Cambridge, MA: MIT Press.

Bloom, B.S. (1956) *Taxonomy of Educational Objectives, Handbook I: Cognitive Domain*. New York: David McKay Comp., Inc.

Bruner, J.S. (1963) *The Process of Education*. New York: Vintage Books, Random House.

Carter, G., Haywood, J. and Kelly, D.T. (1986) *A Case Study in Curriculum Assessment: GCE Engineering Science*. Manchester, UK: Roundthorn Pbl.

Connelly, M.F. and Clandinin, J.D. (1987) *Teachers as Curriculum Planners, Narratives of Experience*. Columbia University: Teachers College Press.

Dean, R. K. and Plants, H.L. (1978) Divide and conquer, or how to use problem solving taxonomy to improve the teaching of problem solving. *Frontiers in Education* Conference Proceedings, 268-275.

Dror, Y. (1971) *Designs of Policy Sciences*. New York: Elsevier.

Edwards, G.C. and Sharkansky, I. (1978) The *Policy Predicament: Making and Implementing Public Policy*. San Francisco: Freeman.

Elmore, R.F. (1979) Backward mapping: Implementation research and policy design. *Political Science Quarterly*, Vol.94.

Geva-May, I. (1993;1995) *Till Death Do Us Part: The Conceptualization of Termination in Public Policy Literature*. CSHE: UC Berkeley.

Geva-May, I. with Wildavsky, A. (1997) *An Operational Approach to Policy Analysis: The Craft. Prescriptions for Better Analysis*. Boston: Kluwer Academic Publishers.

Hallinger, P., Murphy, J. and Hausman, C. (1992) Restructuring schools: Principals' perception of fundamental educational reform. *Educational Administration Quarterly*, Vol.3, 330-349.

Haywood, J. (1989) *Assessment in Higher Education*. Essex, UK: John Wiley and Sons.

Hogwood, B.W. and Gunn, L. A. (1984) *Policy Analysis for the Real World*. Oxford: Oxford University Press.

Kelly, D.T. (1983) A-level engineering science: A progress report. *Research in Science and Technological Education*, Vol.1(1), 89-99.

Kerlinger, F. N. (1973) *Foundations of Behavioral Research*. NewYork: Holt Saunders Int. Ed.

Knight, J., Lingard, B. and Barlett, L. (1994) Reforming teacher education policy under labor governments in Australia 1983-1993. *British Journal of Sociology of Education*, Vol.15(4), 451-466.

Leithwood, K.A. (1986) Current empirical research on evaluation utilization. *Review of Educational Research*, Vol.56(3), 32-58.

Levine, M. A. and Ferman, B. (1985) *The Political Hand*. New York: Pergamon Press.

Levine, M.A. and Sanger, M.B. (1994) *Making Government Work: How Entrepreneurial Executives Turn Bright Ideas into Real Results*. San Francisco: Jossey-Bass.

Lingard, B. (1991) Policy-making for Australian schooling: The corporate federalism. *Journal of Education Policy*, Vol.6(1), 85-90.
Lingard, B. (1992) (ed.) *Schooling Reform in Hard Times*. Deakin Studies in Education Series, 9. Bristol: Falmer Press, Taylor and Francis Inc.
Lynn, L. E. Jr. (1987) *Managing Public Policy*. Boston: Little, Brown and Co.
Majone, G. and Wildavsky, A.B. (1984) Implementation as evolution. In J.L. Pressman and A.B. Wildavsky (eds.) *Implementation*, 3rd ed. Berkeley: UC Press.
May, J.V. and Wildavsky, A.B. (eds.)(1978) T*he Policy Cycle*. Beverly Hills: Sage.
May, P.J. (1986) Politics and policy analysis. *Political Science Quarterly*, Vol.101(1), 109-125.
Nakamura, R.T. (1987) The textbook process and implementation research. *Policy Studies Review*, Vol. 7(1), 142-154.
Nevo, D. (1983) The Conceptualization of educational evaluation: An analytical review of the literature. *Review of Educational Research*, Vol.53(1), 18-43.
Pressman, J. L. and Wildavsky, A. B. (eds.) (1984) *Implementation*, 3rd ed. Berkeley: UC Press.
Schwab, J.J. (1964) Structure of the disciplines: Meaning and significances. In G.W. Ford and L. Pugno (eds.) *The Structure of Knowledge and Curriculum*. Chicago: Rand McNally and Co., 1-30.
Scriven, M. (1977) The methodology of education. In A.A. Bellack, H.M. Kliebard and E. Stake (eds.) *Perspectives of Curriculum Evaluation*. Chicago: Rand McNally.
Thompson F.J. (1984) Implementation of health policy: Politics and bureaucracy. In T.J. Litman and L.S. Robins (eds.) H*ealth Politics and Policy*. New York: Wiley.
Tyler, R. (1950) *Basic Principles of Curriculum and Instruction*. Chicago: University of Chicago Press.
Waks, S. and Lindenlaub, J. (1981) Cognitive levels in basic electrical engineering course. *International Journal of Electrical Engineering Education*, Vol.18, pp. 101-111.
Weimer, D.L. and Vining, A.R. (1989) *Policy Analysis Concepts and Practice*. New Jersey: Prentice Hall.

Pre-and Post Reform Syllabi published by the Israeli Ministry of Education, Jerusalem

Electronics and Computers Syllabus (1983)for secondary schools, electronics trend # 304.
Electricity Syllabus (1982) for secondary schools, electricity trend # 301.
Switching and Control Syllabus (1986) for secondary schools, electricity trend # 301.
Electric System Syllabus (1986)for secondary schools, electricity trend # 301.
Switching and Digital Systems (1991)for A & B levels of secondary schools, trend # 11.
Analog Electronics (1991) for A & B levels of secondary schools, trend # 11.
Theory of Electricity (1991) for A & B levels of secondary schools, trend # 11.
Electronic Systems (1991) for A & B levels of secondary schools, trend # 11.
Matriculation Exams Before and After the Reform. Israeli Ministry of Education. Jerusalem.

Israeli Ministry of Education (1987) (1988) (1989). Matriculation Exams for Secondary School Learners

test paper # 340061 in Fundamental Electronic Theory.
test paper # 340161 in General Electronics.
test paper # 330251 in Switching and Control Systems.
test paper # 330141 in Theory of Electricity.
test paper # 330041 in Fundamentals of Electricity.
test paper # 330261 in Energy Conversion.
test paper # 330061 in Electrical Systems.

Israeli Ministry of Education (1990). Matriculation Exams for Secondary School Learners

test paper # 111222 in Electricity and Control Systems.
test paper # 111224 in Electricity and Control Systems.
test paper # 111331 in Digital and Control Systems.

Israeli Ministry of Education (1993) Matriculation Exams for Secondary School Learners

test paper # 111221 in Electricity Control and Conversion.
test paper # 815101 in Electronics and Computers.
test paper # 111223 in Electricity, Control and Conversion.
test paper # 815102 in Electronics and Computers.
test paper # 841201 in Electronic Systems.