TEACHING AND LEARNING SCIENCE IN PALESTINE: DEALING WITH THE NEW PALESTINIAN SCIENCE CURRICULUM

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Abstract – *Since the establishment of the Palestinian Curriculum Development Centre in 1995 and the development of the First Palestinian Curriculum Plan in 1996, the Ministry of Education has introduced, for the first time in Palestinian history, textbooks for grades one, two, six, and seven. The need for a comprehensive evaluation process for these new curricula has been highlighted by many Palestinian intellectuals, thus questioning the efficacy of the technical approach followed by the Ministry of Education. In the first section, the paper briefly outlines, the specific challenges and tensions in teaching and learning science in the new Palestinian curriculum. I examine the complex history of science education in Palestine during the Israeli occupation and illustrate how the occupation has contributed to the above challenges and tensions. In the second section, the paper discusses the vision adopted by the Al-Qattan Centre for Educational Research and Development (QCERD) which takes an approach to curriculum evaluation and research from socio-cultural perspectives. This vision views the science curriculum as process and praxis, and focuses on what occurs in Palestinian science classrooms. It involves working directly with science teachers at the pre-service and in-service levels, in order to encourage reflection, dialogue and critical inquiry. In the third section, the paper presents the results of ongoing research projects carried out by QCERD concerning curriculum evaluation. Taking the Palestinian school as a unit of analysis, and the science classroom as a laboratory in which each teacher is a researcher, educational theories are translated into a hypothesis that is testable in practice, and the science curriculum is developed and evaluated through a dynamic interaction of action and reflection. Additionally, the paper focuses on how science teachers mediate the overt science curriculum as well as the hidden curriculum, which is embedded in the daily interactions and regulations of school life. I argue that the science curriculum transmits authoritarian knowledge and values by placing the teacher at the center of the educational process, and by neglecting competencies that are necessary for democratic practices in the classroom. The paper concludes by offering a set of concrete policy recommendations about the importance of involving teachers in the process of curriculum evaluation in a way which empowers them as practitioners to reflect on the norms and values that are being presented in the science curriculum and the Palestinian curriculum as a whole.*

Introduction

Most science teachers in Palestinian schools are graduates of the science and the educational science departments in Palestinian universities and colleges. There are eleven universities and five colleges in the West Bank and Gaza that offer Bachelor degrees, ten of these universities and two of the colleges offer a Bachelor degree in science (i.e. mathematics, chemistry, physics, biology, and computer science) and science education (i.e. science subjects together with teaching pedagogies, teaching methods, counseling, curricula, management etc.). Some universities and colleges offer a diploma degree in education and science teaching to pure science students as a minor degree, and to in-service science teachers who seek teaching certificates.

Many of the Palestinian universities have recently introduced graduate colleges and departments, which offer a Masters degree in sciences and in education, and most of its students are from the in-service sector, including science teachers (see Table 1).

TABLE 1: Distribution of graduates by colleges, Department of Science and Education and degrees offered in the year 2001/2002.

Ministry of Higher Education (2002*) Statistical Year Book 2001/2002*, Ramallah, Palestine.

* M.A=Master Degree, B.A= Bachelor Degree, H.D=Higher Diploma, D=Diploma.

In general, most existing institutions of higher education were established during the Israeli occupation by Palestinian individuals and group initiatives, mostly with the support of the Palestinian Liberation Organization (PLO), and with financial contributions from Arab countries. These institutions, together with other educational institutions in Palestine, suffered under the Israeli occupation: repeated closures, military checkpoints, frequent arrests of students and staff, and imposed economic constraints (MOHE, 1997). While the curricula of the pre-university education institutions were under thorough censorship by the Israeli civil administration, the Palestinian higher education institutions were able to maintain their independence, regarding educational programs and curricula. As a result of Israeli occupation measures, these institutions became highly politicized and played a major role in promoting democratic practices in Palestinian civil society: generating public debates, organizing programs of political discourse and resistance, and creating political and intellectual figures who eventually took part in the social and political decision-making processes of the society.

Following the 1993 Oslo agreement, many Palestinian areas in the West Bank and Gaza Strip came under Palestinian control[1], while others remained, remain under occupation. The Palestinian National Authority (PNA) assumed control over the educational system in the West Bank and Gaza and, in 1996, it established the Ministry of Higher Education (MOHE), transferring the mandate of the Council of Higher Education, which was responsible of managing the entire 'post-secondary' education sector until then, to the new Ministry. Meanwhile, most of the 'pre-university' education sector became the responsibility of the Palestinian Ministry of Education (MOE) set up in 1994 (now responsible for over 74% of the schools with 653650 students and 28015 teachers). The other pre-university institutions continued to be the responsibility of the United Nations Relief and Works Agency (UNRWA) (over 14% of the schools with 244711 students and 6946 teachers), and of the private sector (nearly 12 % of the schools with 55121 students and 4376 teachers) (MOE, Educational Statistical Brochure 2001/2002).[2]

In spite of the 'consumer-producer' relationship between the two Ministries (MOE and MOHE) (Sanyal, 1999), by which the MOHE is the consumer of the pupils graduated from MOE, and the MOE is a consumer of the products of the MOHE institutions in the form of teachers and administrators, these two ministries worked and are still working separately in developing their visions and plans. This lack of coordination has led to many problems in the two sectors, and has affected the quality of the pre-service and in-service science teaching programs, and the science teaching profession as a whole.

Concerning the higher education sector, the MOHE is now making serious efforts to improve the critical situation that the Palestinian universities and colleges have reached. Recent reports show that science education programs in

Palestinian universities as well as other programs are facing difficulties at the policy as well as the program quality level. In their report, Hashweh and Hashweh paint a 'gloomy picture' of the state of higher education, indicating the system is nearly on the verge of collapse. They describe the problems in these institutions and show that there are 'difficulties in implementing policies and regulations in a situation characterized by lack of proper administration, planning and policy setting' (1999: 223). Furthermore, results of an evaluative study conducted by the Al-Qattan Centre for Educational Research and Development (QCERD, 2001) are consistent with those of Hashweh's: the duplication of field of specializations and programs, the absence of admission criteria agreed upon by the institutions, and the lack of human resources, together affect the quality of the higher education programs in Palestine. In addition, the QCERD report and the annual report from the MOHE (1997) reveal serious problems with the education programs offered to science students. Many programs are overly theoretical, irrelevant to Palestinian social and economic needs, and neglect the practical dimension of real school settings. These programs do not serve the different school tracks and levels and their curricula are not matched to the needs of Palestinian science teachers. In its defense, the Palestinian MOE inherited an educational system in a state of disrepair caused by the Israeli Occupation. In 1994, the MOE took responsibility for most of the pre-university education sector, and planned to reform the educational programs through its five-year developmental plan. The plan's main objective was to improve the professional quality of teachers through in-service teacher training programs, to develop staff administrative skills, to support the supervision system, and to strengthen cooperation between the Palestinian education sector and the international community. Science graduates who worked in the teaching profession without teaching certificates were obliged to obtain at least a diploma in education or in teaching methods from a university. All teachers, including science teachers, were enrolled in extensive developmental training sessions and workshops during and after school hours.

The MOE assumed control of curriculum matters after establishing a 'Curriculum Development Center (CDC)' which replaced the curriculum committee that worked for nearly two years to produce the first draft of a curriculum plan. New textbooks were introduced in September 2000 for all subjects, in grades one, two, six and seven, thus replacing the Jordanian and the Egyptian textbooks that were used in the West Bank and Gaza during the period of the Israeli occupation.[3] This process will continue until new texts are generated for all grades in all subjects.

Recent statistics indicate that there have been general positive changes in the Palestinian educational system, especially in the year 2000 before the second Intifada began. The illiteracy rate for individuals 15 years or older in the West

Bank and Gaza Strip dropped to 10.8% compared to 13.9% in 1997. The number of schools and kindergartens increased to 2646 in the year 2000 compared to 1910 in 1994/1995. Declines in elementary level dropout rates, increase in female enrollment in schools, and decrease in student/teacher ratio are all examples of improvement in the education sector has improved since 1995 (Palestine Economic Policy Research Institute-MAS, 2002).

Despite the positive changes, the quality of teaching and learning in Palestine is disappointing. Today, science in-service teachers are highly demoralized by the centralized bureaucracy and strict hierarchy of the school system run by the MOE. Furthermore, with the Palestinian economy in collapse, and with the low salaries of the teaching profession and the increase in costs of living, many science teachers seek additional income through afternoon jobs, leaving no time to attend the afternoon training programs offered by the Ministry of Education. Due to the current salary scales, men are leaving the teaching profession, while women are beginning to fill their positions. The noticeable increase in the numbers of women in the teaching profession can also be attributed to the positive social changes in Palestine which allow more women to study and to work (Graham-Brown, 1984). Due to the very high population growth among Palestinians and the tremendous increase in student enrollment at both the primary and the secondary levels, the MOE has given its priority to building schools and renovating existing ones, rather than improving the quality of education (Hashweh, 2001; Rihan, 2001). According to Hashweh, the MOE is grappling with the quantitative problem of providing education for all, rather than with improving the quality of education' (Hashweh, 2001:361).

The outbreak of the Second Intifida in September 2000 and the ensuing escalation of the conflict with Israel have led to severe deterioration of the education sector in Palestine. Many schools have been forced to close because of Israeli sieges and incursions. The reoccupation of the Palestinian territories and the curfew imposed on population centers by the Israeli military has made the situation even worse. Palestinian MOE reports indicate that since the Second Intifada began, 212 schools have been forced to halt operation due to Israeli measures, either because the schools were turned into military camps, or were closed for other reasons due to Israeli military orders. This number has increased since the incursions of May 2002, now totaling 1289 closed schools (MOE, 2002). The MOE has adopted several measures and developed an emergency plan to maintain the educational system. These measures include assigning teachers to schools in their area of residence, recruiting university students, administrators and volunteers to substitute for the sudden shortage of teachers, relocating students to study in their local schools, etc.

The higher education institutions are also suffering in the current situation. Many students and teachers have been unable to obtain access to their universities

and colleges because of the tight Israeli siege. The MOHE has also taken several measures to guarantee the continuity of education in universities and colleges. Some of these measures include allowing students to join courses in other universities closer to their place of residence, extending the term by reducing summer vacation, moving courses to locations outside university campus, and finally, using the internet as a communication tool between students and teachers, which is considered by many observers as a positive step toward self-learning.

In the following section, I will describe the Palestinian Curriculum development process and suggest the need for a new vision of curriculum evaluation. A comprehensive evaluation process illustrates that the new Palestinian curriculum does not succeed in fulfilling the Palestinian need for a democratic discourse.

The Palestinian curriculum development process

In the 1990s, calls came from leading Palestinian educators to include aspects like democracy, citizenship, multiculturalism, and the right to difference in the new Palestinian curriculum. Brown (2001) speaks about three distinct groups through which the new vision emerged: the first group was those Palestinian intellectuals who worked in educational issues but were not academic specialists in education. Their desire was 'to build a more participatory and democratic national culture,' and their focus on democracy became a priority after the creation of the PNA. The second group described by Brown is the educational reformers who shared a critical view of existing educational practices. Their major focus was to develop and apply theories in order to create active, critical, and reflective learners and practitioners. The third group of reformers, according to Brown, consisted of teachers who gathered on educational or political bases, and became active during the first Intifada (1987-1992). Afterwards, some of these groups took a step forward and formalized their activities under nongovernmental organizations and began to focus on teaching pedagogy, methods and social issues such as democracy, identity, and citizenship.

Among those intellectuals of the first group was the late Ibrahim Abu Lughod, a Palestinian political scientist. Abu Lughod led the first politically independent curriculum team and worked with well-known academics and produced a plan for Palestinian education that emerged from extensive consultations with teachers, students, parents, academics and members of the business community (The First Curriculum Plan, 1996). The concept of a 'democratic classroom,' introduced for the first time in the Middle East by Abu Lughod, was one of the innovations based

on a model of social interaction and democratic decision-making processes (Moughrabi, 2002). Brown and Moughrabi explain that this model places the role of the student at the center of educational processes rather than as a 'container of knowledge,' and reconceptualizes the role of the teacher to be a guide and a facilitator of critical thinking through group work, experimentation, case study and other instructional techniques. This requires, according to the plan, 'empowerment' of teachers and students. Teachers must be prepared to be life long learners, and participants in the decisions made concerning curriculum development and policy-making (Brown, 2001; Moughrabi, 2002). At the same time, students must have the opportunity to question, speculate, wonder, and challenge, without the fear that they may give the wrong answer. 'Without confidence in their own abilities to think and question, they will not be equipped to participate actively in other democratic institutions and processes' (Al-Haj 1996: 229). In addition to the emphasis on democratic education and the promotion of critical thinking, the curriculum plan also makes many key recommendations: more focus on producing an identity that is open to other cultures; more emphasis on teaching ethics, expanding the school schedule; abolishing the final matriculation exam known as the Tawjihi, and adopting student achievement in all the three stages of schooling as a criterion for school graduation; replacing the school inspectors with school supervisors and eliminating the tracking of high school students into students of scientific and literary streams.

With respect to the science curriculum plan, the Abu Lughod team proposed a curriculum that transmits relevant, interdisciplinary and integrated knowledge and skills, especially in the technical fields. Inquiry must be the basic approach to teaching science at all levels; questions which enhance creative thinking should be asked and worked on through investigation and experimentation. The plan presents the general objective of science teaching for both the primary and the secondary levels as follows:

1. Becoming acquainted with the Palestinian natural environment and its relationship to humans.
2. Realizing basic scientific knowledge in all disciplines and implementing it in 'the real world'.
3. Acquiring scientific thinking skills and applying them in solving scientific problems in real life.
4. Realizing the importance of science and technology in human lives.
5. Realizing the role of scientists in the scientific development process and human civilization.
6. Enhancing creative thinking and scientific imagination.

7. Realizing the relationship between science and mathematics to technology and other disciplines.
8. Enhancing self-learning and inquiry skills.
9. Acquiring the skills necessary to use science equipment in an effective way.
10. Acquiring scientific attitudes and values.

The CDC created by the MOE which replaced the curriculum team led by Abu Lughod neglected the teams' recommendations, and formulated its own approach (Brown, 2001; Moughrabi et al., 2002).

The CDC developed a curriculum plan and identified four foundations for the curriculum (Intellectual and national, social, cognitive, and psychological. The general four foundations of science teaching originated from the four main foundations and can be summarized as follows (MOE, 1998: 5):

1. Intellectual foundation: The science curriculum seeks to reinforce faith in God, reflection on the universe, the embodiment of 'good' human values and principles, to reinforce the status of mind, to promote the importance of the role of technology and science in developing society and human civilization.
2. Psychological foundation: The science curriculum takes into account the learners' needs, his interests, and his cognitive and physiological characteristics. It also encourages the learner to participate in activities of self-learning and group learning taking into account individual differences, and establishing rules of 'comprehensive experience' in personality building.
3. Social foundations: The science curriculum should strengthen the ties between the learner and the society, and enhance the individual understanding of environment and her/his ability to play an active role in preserving it, solving its problems, as fit to the Palestinian society.
4. Cognitive foundation: The science curriculum takes into account the nature of scientific knowledge, its 'structure', and the relationship between science and technology. It should emphasize the importance of research and cognitive thinking.

These foundations according to Rihan are comprehensive and ambitious, and require vast human and financial resources and political stability. Rihan expresses his concern regarding the MOE curriculum plan, starting that they may be 'overly ambitious' in a sense that they 'could end up being nothing more than a new packaging of old wares' (2001: 29).

The new Palestinian curriculum has culminated in a set of textbooks assigned to single academic subjects, such as Arabic Language, Mathematics, History, Science, etc. The MOE and its CDC introduced for the first time both civic and national education curricula, a step that was considered an important innovation

among most Palestinian educators. However, studies on Palestinian curricula in general reveal that the textbooks are homogenous curricula that are fundamentally similar in their philosophy and approach to many traditional curricula used in different countries, i.e. they take a technical approach based on the assumption that a curriculum can best be evaluated by determining its results. Al-Ramahi and Davis, in their study on primary education in Palestine, have found that ' the new curriculum is highly classified by different experiences, skills and subjects, where each subject kept its status in the hierarchical order of knowledge, at prescribed times, using subject-based textbooks' (2002: 68). The MOE, in fact, imposes an educational system that is quite similar to the one that exists in various other Arab countries: rules that rest on a narrow social base, bureaucracy and an authoritarian approach to management. The centralized educational system where practitioners enjoyed little autonomy was, according to Al-Ramahi and Davis (2002), the main reason for hindering the process of implementing the integrated-learning project and a child-centered approach.

An example of the way in which the educational system is traditional can be seen in the authoritarian role of science supervisors. Focus group discussions carried out by QCERD with teachers and students reveal that the top-down instructions of the training programs held by the Ministry supervisors, especially those training programs concerning the new science curricula, are frustrating because they are compulsory yet irrelevant to teachers' realities and insufficient to change teachers' beliefs and practices (Khaldi and Wahbeh, 2000). Even though the MOE has devoted considerable time and effort to improving the supervisory system, science teachers still view the Ministry supervisors as inspectors who visit teachers once a year detecting weaknesses rather than to help and improve their teaching skills (Khaldi and Wahbeh, 2002).

The above aspects of the curriculum indicate that there is a need for further evaluation. The QCERD is an independent Palestinian research institution established in 1998, and its primary mission is to improve the quality of teacher education in Palestine and to empower the Palestinian teacher to improve her/his teaching qualifications, and to provide teachers with the opportunities to become researchers and reflective practitioners through action research. The Centre perceives its mission as one which is complementary to the work of official and unofficial institutions such as the MOE and non-governmental organizations and universities which are actively involved in planning and providing educational services. The QCERD recognizes the role of the teacher as a producer of knowledge through her/his research, and as a key player in the curriculum development process. Upon production of the new Palestinian textbooks, the QCERD research team responded to public and institutional calls for a comprehensive evaluation of the new Palestinian curriculum.

Rationale

The QCERD, adopts Apple and Beyer's (1998) theory of the social evaluation of curriculum. Our evaluation views the science curriculum as process and praxis, focuses on teacher student evaluation and involves working directly with science teachers at the pre-service and in-service levels, thus encouraging reflection, dialogue and critical inquiry. According to Apple & Beyer, the social evaluation of curriculum enables teachers and educators to discover the lived experience of students, and reveal why curricula fail and why programs are accepted or rejected. This approach to evaluation addresses the power of the official knowledge imparted through specific discourses, and provides realistic answers to important questions such as: 'whose knowledge is presented in the curriculum? Who selected this knowledge? Why is it organized and taught in this particular way? Is this what parents and educators really want? What are the social impacts of this knowledge?' (ibid, p: 342).

In contrast, the technical approach that was adopted by the MOE places emphasis on the process/product rationale, one that relies on measures of students' achievement of scores and on pre and post-tests to evaluate the curricula and its efficiency. Willis (1988) elaborates on the technical approach to evaluating the curriculum, claiming that it assumes that the curriculum can be valued only as it contributes to certain extrinsic goals, and only its 'utilitarian ends' justify the curricula means. He adds:

> 'The technically oriented evaluator tends to look but not to see, to hypothesize but not to realize, to find facts but not to make meanings, to participate but not to create, and to evaluate but not to value.' (p. 332)

We take the Palestinian school as a unit of analysis. The integration of both the content knowledge presented in the curriculum and the pedagogical knowledge can help us learn more about how the new Palestinian curriculum works. This means that we have to look at the basic foundations and the general objectives of the new curricula, the textbooks, teachers and students and administrators' practices, and the power relations among them. And this also means studying the process of policy making and the type of communication within the educational organization i.e. the MOE. The model of pedagogic practice outlined by Bernstein (1990) and elaborated by Morais, Davis, Neves, and Danial (Morais et al, 2001) can form a basis for conceptualizing types of pedagogical practices and the type of pedagogical knowledge transmitted through these practices. The competence versus the performance model provided by Bernstain (1996) and applied to different pedagogical practices, i.e. discourse, time and space, evaluation, control,

autonomy and others, show how a society can help in understanding the pedagogical knowledge transmitted throughout the Palestinian educational system.

The QCERD Centre realizes, however, that schools are not 'isolated entities,' that they have to be examined in their socio-economic and political contexts. According to Apple (1979; 1995), schools have three functions: 'accumulation,' through which students are hierarchically ordered, grouped, and taught different norms, skills and values in order to be prepared for the needs of the job market; 'legitimation,' by which social control is practiced and dominant ideologies, values and norms are filtered and conditions for their acceptance are created; and 'production,' the process by which students are prepared to enter universities where they eventually work in the production of knowledge. In order to have a clear vision of how curricula operate, and to understand the functions of the school, it is necessary to make connections between the curricula and the culture of the society in which it is produced.

In the future, other areas of schooling will need to be scrutinized when adopting the socio-cultural perspective of curriculum evaluation. The QCERD will need to look not only at the overt curriculum represented by various materials and texts that are filtered through teachers, but also at the 'hidden curriculum' that is embedded in the daily interactions and regularities of school life. According to McCutcheon, the hidden curriculum 'is not intended and is transmitted through the everyday, normal goings-on in schools' (1988: 191). But for others, the hidden curriculum is intended in that the way knowledge is selected, organized and assessed in schools is 'taken-for-granted' to be legitimate knowledge and to reflect the interests of powerful groups in society (Young, 1971; Keddie, 1971; Bourdieu & Passeron, 1977; Apple, 1995). Acknowledging this, Willis (1977) and Giroux (1983) show how students might, in fact, resist the official knowledge imposed by powerful groups through the functions of schools, by criticizing the functionalist perspective of the hidden curriculum that considers students as passive receivers of social norms. Apple & Beyer (1988) complement Willis (1988) and Giroux (1983), claiming that students have the ability to reinterpret dominant ideologies in the overt and the hidden curricula, pointing out that:

> 'we cannot take for granted that students are passive receptacles into which the school 'pours' ideological content and values; nor should we assume that students do not have some creative responses to the sorting and selecting functions of the school.' (p. 343)

For example, following Merton (1957), Peter Woods (1980) studied students' reactions to school goals and methods of attaining these goals and found that these

reactions ranged from acceptance to rejection. Woods adds that many students reject the 'rules, rituals, and regulations' and may 'disrupt lessons and even physically assault staff or destroy properties' (pp.14-18). Woods also mentioned that there are students who reject the school norms but they substitute others. This group, 'the rebellions,' as Woods calls them, is less threatening than the first group that he calls 'the intransigence'.

In the following section, I will present results of an ongoing research project carried out by the QCERD concerning the new science curriculum, which has adopted the socio-cultural perspective and takes the Palestinian school as a unit of analysis. Among the findings is the fact that Palestinian classrooms are not based on democratic practices and instead transmit models of knowledge based on authoritarianism.

Knowledge and values in the new Palestinian science curriculum

Methodology

Taking the socio-cultural perspective of curriculum evaluation as a base, and the school as a unit of analysis, the QCERD worked with its Action Research Unit (ARU) with teachers at pre-service and in-service levels to evaluate the new science curriculum through action research projects. The ARU held focus group sessions with school principals, teachers, parents, students and supervisors who are the main key persons responsible for training and monitoring the educational process. In addition, the unit analyzed the new science textbooks and studied the text, signs, pictures, and relations among them. The unit examined the issue of educational consistency in the science curriculum and how the goals of the science curriculum and the general basic principles are interpreted and incorporated by the textbook writers. Most importantly, the unit studied how competencies and values such as cognitive competencies (process of scientific thinking, higher order and critical thinking, reflection, etc.); socio-affective competencies (participation, cooperation, and responsibility) personal-social values (personal realization, self-confidence, justice, truth, and persistence and right to difference), and social values (democracy, citizenship, multiculturalism, etc.) are presented in the curriculum and are mediated by teachers.

Classroom observation, teacher diaries and teacher conversations were considered major tools for data collection concerning pedagogical practices. Within action research projects, the ARU worked with a group of science teachers on specific science units selected from the textbooks. The teachers with the center's researchers reformed the chosen unit to coincide with new approaches in

teaching like 'integrated teaching and learning', 'science technology and society approach', 'authentic assessment approach', etc. Then the teachers applied the reform unit in their classrooms, video taping their classes, writing diaries, and returning to meet with the group to discuss the implementation of the unit.

Findings and discussion

Analysis of the data, collected from science textbooks, classroom observations, and interviews shows a number of results which can be grouped under two categories: first, the content knowledge transmitted from science curriculum objectives and from the goals, content, activities, and evaluation in the textbooks, and secondly, the pedagogical knowledge transmitted from pedagogical practice.

Content knowledge

The Palestinian science curriculum is embodied in science textbooks which have been approved by the MOE and given to school teachers as 'ready to teach'. They are taught by subjects, each given a particular number of units. These subjects are: Humans, Plants, Animals, and Microorganisms, Matter and Energy, Environment, the Earth and the Universe, the Atmosphere and Meteorology, Communications, Science, Technology and Society. The general objectives of the new science curriculum (MOE, 1998) include the transfer of scientific knowledge to students and the promotion of scientific thinking, problem solving, innovative and critical thinking, inquiry and investigation and individual initiative. Content analysis reveals that the new science textbooks fail to emphasize those cognitive competencies that are fundamentally expressed in terms of investigative process (e.g. hypothesis formulation, planning experiments, results interpretation), or the competencies for developing them (scientific rigour, learning to think, organizing information).

The science curriculum emphasizes the need to understand the general principles, concepts, and theories that explain the world around us. In general, the texts appear to transfer a significant body of scientific knowledge to students. However, they tend to focus more on results than on the process of scientific discovery and investigation. In essence, the texts present a body of knowledge that students are expected to learn, understand and recall.

Analysis of the activities in the new science textbooks reveals that most of them represent lower order thinking activities. Students are offered the results of scientific exploration. They are not encouraged to experiment; they are only

instructed to distinguish between what is true or false. Students also are asked to measure, draw and calculate without knowing why they are doing so.

Scientific concepts and theories are presented using difficult and complex language. Therefore, students are likely to end up memorizing key concepts without fully understanding them. The result is that students will often rely on intuition rather than scientific concepts and may end up holding misconceptions about science. The texts fail to establish a link between observation and conclusion, thereby leaving students unable to understand the purpose of the scientific experiment or its inner logic.

An examination of the evaluation process reveals the following: most of the questions focus on results-whether students understand general principles, whether they can apply them and eventually recall them. Few questions call for analysis and evaluation and fewer still encourage students to engage in higher order thinking. To a large measure, the texts are test-driven. The texts seem to suggest that there is a scientific method that one can use by following specific steps and procedures. This process does not encourage scientific thinking because the texts move back and forth between various kinds of questions, answers to those questions, and experiments that test those answers.

With reference to scientific literacy, the QCERD evaluated one unit (the human body) in the science textbook (grade 7) according to criteria outlined in Chiappetta, Sethna and Fillman (1991). The purpose was to study what content is emphasized relative to the various themes of scientific literacy, such as:

1. The knowledge of science[4]: facts, concepts, principles and laws, hypotheses, theories and models; and asking students to recall knowledge information.
2. The investigative nature of science: whether materials require students to answer a question through the use of materials or through the use of charts, tables, to make a calculation, to reason out an answer or engage students in a thought experiment or activity.
3. Science as a way of thinking: whether materials describe how a scientist experiments, show the historical development of an idea, emphasize the empirical nature and objectivity of science, illustrate the use of assumptions, show how science proceeds by inductive and deductive reasoning, gives cause and effect relationships, discusses evidence and proofs and highlights the fact that science is a discipline that is disposed to self-examination.
4. The interaction of science, technology and society (STS): whether materials describe the usefulness of science and technology to society; stress the negative effects of science and technology on society; discuss social and ethical issues related to science and technology; illustrate possible careers in scientific and technological fields.

We obtained the following results (Moughrabi et al., 2002):

a) Analysis of scientific literacy themes in the narrative text reveals the following percentage distribution: the knowledge of science (73%), the investigative nature of science (12%), science as a way of thinking (5%), and the interaction of science, technology and society (10%).
b) Analysis of the specific objectives of the unit reveals the following points of emphasis: knowledge of science (71%), the investigative nature of science (12%), science as a way of thinking (8%), and the interaction of science, technology and society (12%).
c) Analysis of the questions reveals the following points of emphasis: scientific knowledge (73%), the investigative nature of science (5%), science as a way of thinking (19%), and the interaction of science, technology and society (2%).
d) Analysis of the figures and illustrations reveals the following points of emphasis: scientific knowledge (76%), the investigative nature of science (12%), science as a way of thinking (5%), and the interaction of science, technology and society (5%).

The content analysis reveals that the science curriculum tends to emphasize the transfer of a body of scientific knowledge to students and ignores the investigative nature of science, thinking competences and the interaction of science, technology and society that are essential for the promotion of scientific literacy and values of democratic practices. These results coincide with what Brown (2001) says about the Palestinian science textbooks that they are still 'based on the idea that they impart knowledge from a position of authority and their encouragement of critical, creative, and independent thought is limited' (p. 24).

Pedagogical knowledge

Despite the attempts to build more interactive pedagogy, science textbooks fail to provide students with a constructivist approach in accord with the nature of science, as it claims to do in the general objectives. Instead, it introduces scientific knowledge as a set of fixed and discovered truths to be taught by the teacher. As a result, the teacher is placed at the center of the educational process while the students are considered to be passive receptors rather than active disseminators of knowledge.

Furthermore, the new science curriculum fails to foster personal and socio-affective competencies. Classroom observations reveal that science teachers, especially those who are new to the profession, tend to use the space allowed (through pedagogic practice) less than is desirable and mostly adhere to the

instructions given in the curriculum's specific guidelines (sometimes given by their supervisors) for discipline matters. Factors like teachers' ideologies, school culture, classroom settings and peer influence play an important role in the way teachers mediate the messages contained in the science curriculum and the way they direct their practices. In many cases, teachers tend to recontextualise the general goals in the science curriculum in a way that undervalues socio-affective competences. For example, because of dense subject matter, overcrowded classrooms, and the test driven nature of the curriculum, science teachers try to cover the material and do not have much time to engage students in discussion and cooperative work. As a result of this undervaluing, not only the principles of the curriculum are lost but also, more importantly, there is a tendency to reduce learning to its instructional aspects and to focus on its lower cognitive and socio-affective developments. Al-Ramhi and Davis (2002) indicate that despite the training programs given by the MOE concerning teaching practices, lecturing was still the dominant pedagogy, where 'emphasis was still laid on attaining the status of knowledge, rather than the process of acquiring knowledge' (p. 69).

The low quality of higher education programs which separate theory from practice in actual settings, leads Palestinian science teachers to rely on their colleagues and in many cases on their previous knowledge about teaching acquired from their own school teachers when they were students. Hargreaves (1995) writes that many teachers give up their 'ideal theory world' obtained at university because of the power relations between colleagues, students and administrators, in order to coexist with the school culture. This highlights again the need for cooperation between the MOE and MOHE.

The suggestions of Palestinian educators for curriculum reform are practically absent in the new curriculum produced by the Ministry of Education. Instead of the first curriculum team plan for educational reform and innovative curriculum based on democratic decision-making and on critical thinking, one finds a notion of curriculum that transmits authoritarian knowledge and values. The cognitive and social competencies that are necessary for developing a critically thinking person and self-learner are limited in the new science curriculum.

Studies on education for democracy focus on the notion that cognitive, personal and socio-affective competencies such as critical thinking, participation, cooperation, responsibility, personal realization, self-confidence, justice, truth, and persistence are all principles necessary for developing a democratic society (Dewey, 1916; Wood; 1990; Smyth, 1997 and others). However, social evaluation of the new Palestinian science curriculum shows that attempts to filter notions of democracy to the school level often fail to bring about any significant levels of change.

For many, the new Palestinian curriculum is a site of tension between progressives and conservatives, and for others the resulting textbooks are an uneasy compromise 'with something for every one' (Brown, 2001). Such compromise can be seen in the science curriculum concerning, for example, the role of gender. Men can be seen in some illustrations doing housework and working in the kitchen. Illustrations also show veiled women coexist with those unveiled. The science curriculum is also a topic of debate between secular and religious parties in the Palestinian society, as it is in many other countries. Koranic verses are cited at the beginning of various units and concern the subjects being studied in this unit. Conservatives justify citing Koranic verses in science textbooks in order to show how science is compatible with Islamic religion and a way to integrate science with other subjects. Progressivists with secular views, on the other hand, say that this citing supports the traditional point of view about scientific knowledge as a fixed truth and prohibits students in the science classroom from practicing the skills of doubt which is one of the most important aspects of science. Even though, there are no studies been conducted on how inserting Koranic citing affect students' thinking skills, it is safe to say that teachers' ideology plays an important role in forming the kind of knowledge imparted to students through her/his pedagogical practices.

In general, the new Palestinian curriculum leans toward authoritarian pedagogy. Despite introducing new subjects such as Civic Education and National Education, in the Palestinian curricula, which include material on human rights and democracy, there is no clear pedagogy that incorporates the values and attitudes of democracy. Values that permeate the new textbooks focus on order, discipline, cleanliness and personal hygiene, respect for parents, teachers and others in authority, respect for elders, and other social and religious values (Moughrabi, 2002). Moughrabi adds that there is emphasis placed on the need for affiliation such as social harmony, getting along with others, but on the other hand there is no practical attempt to introduce 'achievement' as a necessary theme for economic development and growth. Relating to the science curriculum, the traditional approach of compartmentalizing science from other social sciences still persists; there is no such pedagogy of incorporating values and attitudes of democracy among science subjects.

For teachers, the MOE school system is highly centralized and bureaucratic and the supervisory system for them is still, in many of its aspects, authoritarian. Many educators point to the common characteristics between the existing Palestinian educational system and that in other Arab regimes (Hashweh, 1999). Hashweh says, 'Palestinian schools still concentrate on rote learning and memorizing, instead of developing self-learning, critical thinking and problem-

solving skills that help in personal and social decision making' (1999: 24). The Arab educational systems, according to Bahlole (1997) and Sharabi (1975), share common features that concentrate on rote learning, punishment, and ignore the role of the mind. These educators consider values such as affiliation, respect of authority figures, and dependency obstacles to democracy which reinforce authority in society. Moughrabi goes further, claiming that the Palestinian Authority, since it assumed control in 1994, has 'imposed patterns of governance quite similar to those that exist in various Arab countries' and 'replicates the very same structure and procedures that exist in those countries especially in the field of education' (2002: p11, 12).

There is much evidence to suggest that Palestinian schools which use the newly implemented Palestinian curriculum play an important role in accumulating, legitimizing, and producing the knowledge and values of control and authority. This role is emphasized by the deteriorating conditions of the Palestinian higher education system, which has made no contribution to curriculum policy. The 'consumer-producer' relationship model of teachers and students between the MOE and the MOHE (Sanyal, 1999), would not necessarily work without the consumer-producer model of knowledge, i.e. the process of transforming the role of teachers from consumer and transmitter of knowledge to an active producer of knowledge. This model reveals the manner by which power, control, and authority function through the curriculum and how they shape the organization of Palestinian society itself.

Internal critics of the Palestinian educational system and the new curriculum are now questioning the kinds of knowledge and values this curriculum offers to Palestinian students. Today, what is ultimately needed is a new interactive pedagogy that can penetrate the educational system and can emancipate rather than domesticate the individual, and what matters for the future is how rather than what subject matter is taught. The 'banking' model of knowledge and teaching can no longer be justified in the educational system (Freire, 1970), and the key element for change must be the Palestinian teacher.

Teacher 'empowerment' through a new educational vision

Teachers' empowerment lies in the explicit recognition of the teacher as the key to professional and curricular development. Educators need to know how teachers learn, what types of knowledge and levels of knowledge acquisition are necessary to become effective teachers, and what contexts are most conducive to learning how to teach. This cannot be done without cooperation between the MOE and the MOHE.

The model of curriculum innovation presented by Lang and others (Lang et al., 1999) which takes either an imposed path from the government, or a self-organized path within school practices, links curriculum innovation and teachers' professional development. In the case of the imposed curriculum, failure can be related not to teachers lack of professionalism, but to 'insufficient consideration of teacher qualifications, the existence of different goals for pre- and in-service teacher training, contradictory demands of different stake holders and controversial intended outcomes of reform' (p 123). The obstacles faced the implementation of Machar 98 (Tomorrow 98) project initiated by the Israeli Ministry of Education, Sports and Culture is one example among others given by the authors to illustrate how curriculum innovation and teacher professional development are linked. According to the authors, this imposed reform and its new 'science and technology' curriculum, that aimed to integrate technology into science (biology, chemistry and physics), faced obstacles to a successful implementation mainly because of the lack of coordination between the Ministry (the party that was responsible for the in-service teachers), and the Israeli universities, where little was done to change pre-service teacher education.

Educational reform is needed in order to raise the quality of education in Palestine. The reform should be based on the 'micro level' i.e. on the school level where schools can be sites for reflection and constructive self-criticism. (Land et al, 1999). The Palestinian MOE, on the other hand, insists on 'reform on a macro-level' where outer control of input and output of the educational system is practiced. According to Terhart (1999) this kind of control is not concerned with indicators of quality, but with 'accountability' concerns based on students' performance.

The QCERD (2001) has developed a new vision for the educational system in Palestine, which relies on a 'partnership' model between the MOE and the MOHE, where schools are settings and classrooms are libraries and in-service and pre-service teachers, university teachers, and administrators work collaboratively in a real authentic learning social context (Vygotsky, 1978; Cochran, DeRuiter, & King, 1993; Bullough & Gitlin, 1991). Within this social context, situated knowledge is constructed and transformed to other settings (Brown, Collins, & Duguid, 1989). Gordon Wells (1999) suggests that situated activities within a social context are a site of potential change and renewal since every situation is different and unique, thereby challenging the participants to construct new solutions. Following Vygotsky, Wells discusses how collaborative group work, dialogue, and inquiry-oriented practices are essential components of his proposed model about schools and classrooms as 'communities of inquiry'. According to this model, inquiry is placed at the heart of the curriculum and the teacher's role

is seen as co-inquirer with the students engaged in critical thinking and democratic decision making processes.

Following from this, the QCERD, through its ARU has begun to implement the 'partnership' model. Pre-service science teachers from different Palestinian universities and colleges, together with in-service science teachers coming from the MOE's schools, work with the ARU's researchers in collaborative action research. According to Elliot (1991), collaborative action research supports the transformation of teachers' and facilitators' consciousness through reflection on their current practices, suggesting alternative actions, and providing a context of implementation and evaluation of these actions. Action research facilitates the teacher's empowerment process by reconceptualizing her/his role as producer rather than user of knowledge. The participants in action research work on projects with different topics of investigation through which purposeful situated and authentic activities are incorporated, and the new science curricula are evaluated. Through the action research projects undertaken by QCERD, pre-service and in-service science teachers learn to become researchers and reflective practitioners in their schools (Schön, 1983). For example, pre-service teachers at the Educational Sciences College in Ramallah, worked with in-service teachers in UNRWA schools under a collaborative action research project run by the QCERD action research unit (Al-Qura'n, 2001). The participants worked on science curriculum development and evaluation by applying the 'curriculum inquiry cycle' model (Northwest Regional Educational Laboratory, 1998) and found that the project improved teaching and learning processes, provided teachers with new knowledge and skills to examine science concepts, and to relate science activities to everyday life and to the Palestinian context. Furthermore, teachers acquired new skills and learned how to implement new methods in which teaching processes become student-centered.

Another example of collaborative action research held at the QCERD was the Science, Technology and Science project (STS) (Khaldi & Wahbeh, 2000), through which the pre-service and the in-service teachers, together with the researchers, worked on developing a science unit on water from the STS perspective, and included social problems caused by the misuse of water resources. As a result of joint reflection between the participants, the project enriched teachers' insight into the problems of their teaching style, and facilitated an important change in their beliefs and practices concerning student-learning abilities.

Thus, in the QCERD action research projects, schools and classrooms are considered to be places of inquiry where knowledge is created and recreated between the participants, and teachers are empowered by their participation in curriculum development and evaluation processes.

Conclusion

I have attempted to evaluate the new Palestinian Science curriculum from a socio-cultural perspective, beginning with a review of the historical and the current situation of Science Education in Palestine. By taking the school as a unit of analysis and considering the 'school culture' and the social power relations outside, I tried to show how Palestinian schools are operating as agents of accumulation, legitimization, and producers of knowledge and values of control and authority.

The MOE has failed to integrate the notions of democracy that were called for in the First Palestinian Curriculum Plan and by many Palestinian educators. The new Palestinian science curricula (Grades 1, 2, 6, and 7) represent official texts produced by the MOE and transmit aspects of authority which many have described as replicas of the educational systems in most Arab countries.

The notions of the 'democratic classroom' and the 'community of inquiry' can only be achieved through a real partnership between Palestinian universities and schools, where teachers and researchers work collaboratively to critically evaluate the role of schooling in Palestine. Moore & Young, following Collins (1998) and Alexander (1995) argue, 'it is the social nature of knowledge that in part provides the grounds for its objectivity and its claims to truth' (2001: 450). This argument is the foundation of what has been recently called the 'social realist theory of knowledge,' which has as its first goal to reveal the way in which external power relations and control affect knowledge, both in research and curricula.

The partnership model proposed earlier, challenges the MOE and the MOHE to move towards connectivity between disciplines and integrated subjects rather than isolated entities knowledge, and towards general skill knowledge rather than a curriculum based on subject matter.

Finally, science education in Palestine lacks an interactive pedagogy for incorporating the notion of democracy. The need for democracy cannot simply be translated through peppering textbooks with words and principles of democracy. I agree with Carr (1998: 337) who points out the relationship between democracy and curriculum by saying:

> ''Democracy' and 'curriculum' stand in a reciprocal relationship such that each provides the foundation on which the other is erected. To recognize this is to acknowledge that without a democratic transformation of society a 'curriculum for democracy' will remain ineffective' and that without the educational and political struggle to promote a 'curriculum for democracy' the further democratization of society is unlikely to occur. The democratic transformation of both the curriculum and society is thus the condition for the democratic development of each.'

Notes

1. These areas are now being reoccupied by the Israelis
2. UNRWA schools serve refugee students from kindergarten to grade 9. These students must enroll in governmental schools for secondary education. While students at UNRWA schools follow the National curriculum used in governmental schools, students at private schools follow other foreign syllabi besides the National curriculum.
3. The new Palestinian science textbooks are based on the general philosophy of the Palestinian curricula and on the new science curriculum outline.
4. We must be aware that cognitive level objectives are easier to write, more specific and cover a lot of content. That is why we expect a higher percentage of this type of objectives but the percentage can give us an idea of how much the science curriculum is biased towards these objectives.

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