Changes in Teachers' Classroom Instruction as a Result of Training in Computer Technology

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Abstract

This article presents a study that was carried out two years after teachers completed a training course in computerized instruction, entitled "Intel Education for the Future". The purpose of the study was to measure the degree to which the teachers internalized the skills taught in the training course, thereby, assisting them in integrating the use of the computer in the classroom. For this purpose, certain parameters were chosen: the teacher's method of working in the classroom, the effect of computer instruction on the students and the difficulties encountered upon integrating the computer in the classroom. The research tools were questionnaires and interviews. The main conclusion of the research was that the teachers successfully internalized the skills needed for the use of technology. Teachers are now using the computer to search for information suitable for worksheets and tests and for e-mailing their colleagues. Most of the teachers noted that the most useful tool for their work is the office program. The teachers pointed out that the use of computers raises the students' motivation and improves their understanding of the material. They did not report any special difficulties in integrating the computer into their teaching methods.

Keywords

computer technology, computer instruction, teacher training

1. Introduction

The spread of the computer into our lives has been powerful and swift. The first computer began operating in the mid 1940's and today. some 60 years later, the computer is vital to all aspects of our economic, social and education systems. It appears that despite the initial idea that the computer could replace the teacher, since the early 1990's, the computer has no longer been viewed as the miracle machine that is capable of achieving great tasks in education without teacher intervention. The purchase of computers and software is no longer viewed as sufficient to achieve the anticipated goals of integrating computerized instruction (Millin & Givon, 1993).

Many researchers (Fischer, 1996; Mavrech & Hativah, 1996; Taylor, 1987) discuss the expected changes in the role of the teacher as a result of computerized instruction. In their opinion, the teachers' role will change in such a way that their authority will no longer be derived from the knowledge they

possess, but from their ability to navigate, organize, and critique existing knowledge, as well as to supervise and facilitate learning. Fisher (1996) describes the teacher who uses the computer in the classroom as a teacher who relinquishes his/her role as the source of knowledge and takes on the roles of a partner in learning and a facilitator of instruction that observes from the sidelines and intervenes only when guidance is necessary.

1.1 The Pedagogical Approach of Teachers

According to many researchers, the most common variable for successful computer integration in the classroom is the teacher and his/her approach to change (Adams, 1985; Amiad, 1991; Hannafin & Savenya, 1993; Katz & Offir, 1996; Marcinkiewicz, 1994). It is of vital importance that teachers understand the dynamics of innovation, efficiency and use upon initiation of the process. Findings from the classroom have shown that teachers have difficulty in understanding exactly what needs to be done to implement change. Despite their efforts at using software, teachers find it hard to find the right way to integrate specific computer programs in the lesson. They are not able to realize the full potential of the program or how to reach its goals (Fullan, 1992). In addition, Zahavi and Shemesh (1996) indicate that it is not enough to prepare detailed instruction manuals on how to teach computerized instruction without rendering the teachers proficient in pedagogical software. In their opinion, there needs to be an examination of the process of integrating learning in the student-material-computer-teacher interrelationship. From their reports from visits to classrooms and conversations with teachers, they felt that the teachers viewed their role as subordinate to the computer and that the teachers felt that they were not supposed to interfere with the learning process taking place between the student and the computer. It did not seem clear to the teachers what the students were doing on the computer. They could not help them when the students asked for their help because they did not understand the structure of the programs and the various problems they presented to the students. In addition, the teachers did not make an explicit connection between the computer program and the teaching that occurred in the classroom.

Honey and Moeller (1990) found a connection between the teacher's pedagogical outlook and the level of integration of technology in their classroom. The results of the study differentiate between teachers with a high integration of technology and those with a low integration of technology in their classrooms. In those classrooms where the level of integration was high, the teachers believed that the use of technology, such as telecommunications and multimedia, provide the students with an enjoyable way to absorb content in a creative manner. They believed that the students use computers mainly as a tool to develop individual thinking leading to a more thorough investigation of the subject matter and that students spent less time learning facts and more time on research and developing thinking skills. In contrast, in classrooms where traditional teaching took place, there was a lower level of computer integration and the teachers lectured to the students through the use of textbooks.

The question of accessibility of the computer is another crucial factor affecting its use by teachers. Teachers who have access to computers report using it regularly for preparing materials, for

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computerized instruction, for preparing computerized teaching aids and for e-mail (O'Dwyer, Russel, & Bebell, 2005).

1.2 Training of Teachers

Research indicates that the key to correct integration of the computer in the classroom is dependent upon the confidence of the teachers and their level of training (Almog, 1997; Becker, 1994; Glennan & Melmed, 1996; Netz, 1988). Peled (1991) explains that the computer is not going to replace the teacher. In fact, it is a powerful tool in the hands of the teacher. Therefore, the system must train teachers in the skills and abilities that are required to meet this challenge. The key to correct usage of the computer is the ability of the teacher to use the computer independently and wisely.

The more teachers learn about computers, the more seminars they participate in that deal with specific subjects connected to teaching, the better they will be able to integrate the computer into their teaching methods (Hebenstreit, 1985; Rakes, Fields, & Cox, 2006; Yaghi, 1996). Training courses for teachers should emphasize the essential change in the teachers' role from conventional teaching methods to computer-oriented teaching methods (Hatfield, 1992; Morris, 1992; Steen & Taylor, 1993). Training courses should be based on the correct and logical combination of 3 spheres: the educational, the scientific and the technological (Givon, 1996). Batane (2004), Silvernail and Lane (2004) and Rakes, found that teachers with a high orientation to computers also attend more professional training courses and own personal computers.

1.3 Purpose

The purpose of the study was to examine how well the skills of integrating computer instruction had been assimilated after a two-year period from completion of the training course. The training course was entitled "Intel Education for the Future". During the program, the participants were exposed to a wide array of programs and computer tools and varied methods of integrating computer instruction.

The research questions of the study were:

1) How did the training course influence the teachers' use of the computer?

2) How did the training course influence the instruction of the teacher in the classroom?

3) How did the use of the computer in the classroom affect the students?

4) What were the difficulties encountered in incorporating the computer in classroom instruction?

2. Method

The study was conducted in Israel in 2004, two years after the completion of the Intel course to test the long term effect of the training on the teachers.

Different populations were examined by different research tools:

1) A sample of 1,325 teachers who participated in the Intel course responded to a closed questionnaire that included questions such as, "What content did the course include?" "To what extent did the course prepare teachers to teach the subjects that were taught in the course?" "Did the skills taught in the course help teachers to integrate technology in their classroom activities?"

2) A sample of 553 teachers who participated in the Intel course participated in a telephone survey whose purpose was to check the degree to which information technology was implemented in the classroom after the training course. The survey included closed questions in subjects such as the use of learning aids that were taught in the course, the degree of integration of information technology in the classroom, new learning strategies, changes in teaching methods, the influence of the computer on the students and the difficulties encountered in integrating computer technology in the classroom.

3) Fifteen teachers who participated in discipline-specific courses (the humanities, mathematics, science and language arts) were interviewed. The semi-structured in-depth interviews included open questions related to subjects such as the degree to which the teachers used the computer in classroom instruction and its influence on teaching and learning.

3. Results

By analyzing the quantitative and qualitative data four categories were defined. Table 1 presents the four categories:

Table 1. Four Categories

1	2	3	4
Content of training course and its effect on the teachers	The influence of the training course on the teachers' instruction	The influence of computerized instruction on the students	Difficulties in integrating computerized instruction

3.1 Content of Training Course and Its Effect on the Teachers

To the question of whether their exposure to the Intel course was their first exposure to learning computerized skills, only 23% of the participants answered yes (77% answered no). Other training courses which teachers had attended included teaching in a computerized environment, building projects, building websites, etc. To the question whether, as a result of this exposure, they would participate in additional training courses, 28% of the participants answered yes (72% answered no). However, from the interviews, it was apparent that there was a significant influence on the teachers following the training given in the Intel course. Many teachers felt that "the training course contributed greatly to bringing me into another era".

Most of the teachers pointed out that, following the training course, the computer became an additional teaching tool. The integration of computerized instruction caused a significant change in the teaching process so much so that entirely new lessons plans integrating computers were created. As the teachers commented, "The computer caused a re-organization of the material into a more organized and better classification of the work". The teachers emphasized their feeling of mastery of the computer and one of the teachers expressed it quite well when she said, "I am no longer frustrated; I have mastered the

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computer".

A number of teachers emphasized the contribution of the training course in raising their confidence and lowering their fear of using computerized instruction. The training course gave me a feeling of confidence even though I did not have a lot of previous knowledge. There were some teachers who, before this training course, were wary of using the computer. As one teacher described it, "There were some teachers who before the training course were afraid to enter the computer room and this training course enabled them to come to terms with their fears. Now, with the material they have learned from the Intel Project, they are preparing new lessons".

All of the teachers interviewed related to the future implications of the training course and stated that, as a result of the training course, there was an increase in:

1) The strengthening of their personal knowledge in using office and the Internet.

2) Improvement of their online activities.

3) Collaboration between the members of the school teaching staff, as part of the process of using team work in the schools.

4) Acquiring skills for integrating computer instruction in the learning process in the classroom.

5) Use of the "Tools Folder" created by the teachers which was easy and accessible for reviewing and incorporating the lessons learned from the instruction manual. The manual which was handed out in the training course included a collection of ideas, tools, and skills for the teachers' use.

6) Implementation of the learning units that were created in the training course.

3.2 The Influence of the Training Course on the Teachers' Instruction

In the questionnaire, the teachers were asked if the frequency of certain activities increased as a result of the training course. The questions asked about activities such as the use of computers to present information to the students, the use of the Intel units in the manual as a primary guide for instruction, the use of research questions, etc.
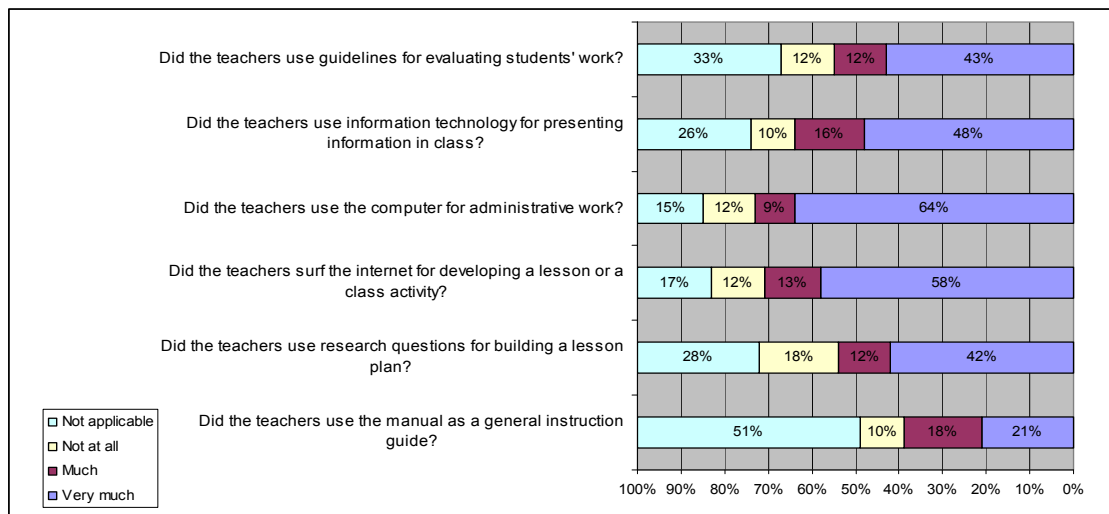

Figure 1. The Use of Computers by Teachers

From Figure 1, we can see that, as a result of the training course the teachers used the computer more for administrative purposes (73% of the teachers). The teachers had more access to the Internet for purposes of developing lessons or other online activities (71% of the teachers). The teachers used more technological means to present information to the students (64% of the teachers).

The teachers were asked to indicate how they integrated computers into their work in the classroom. The scale of values had 6 levels where 6 was "a great deal" and 1 was "not at all".
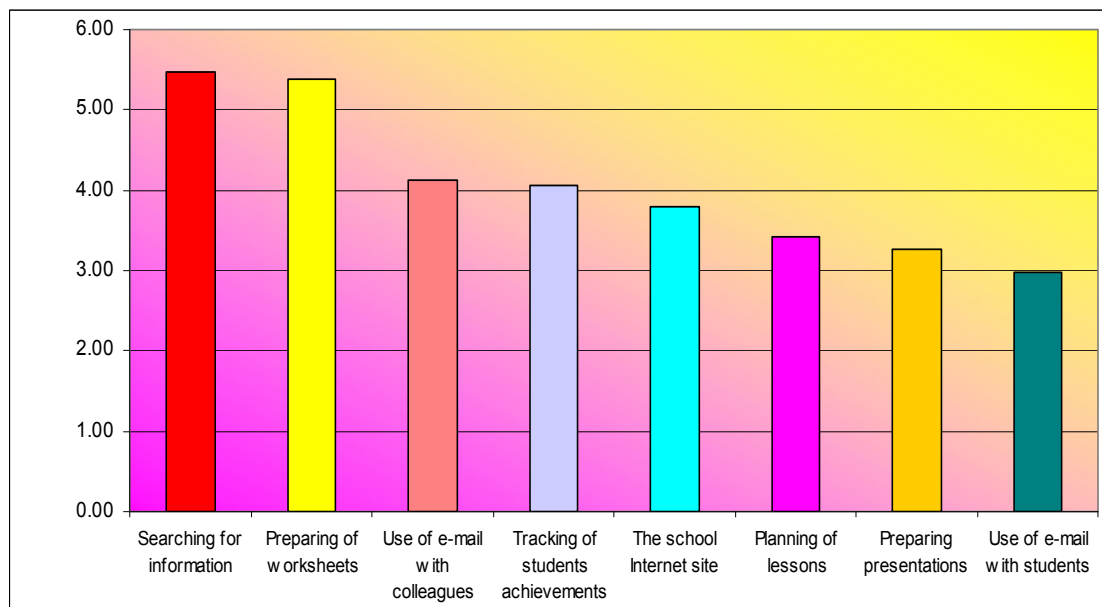

Figure 2. The Use of Computers by Teachers for Work Purposes (Average of Answers of the Teachers)

We can see from Figure 2, that the scale of averages ranges from very high to medium-low and moves between an average of 5.47 to an average of 2.97 (on a scale of 6 levels).

The tools learned in the training course were used most for searching information (average of 5.47; deviation of 0.86) that matches the average of Wasserman and Millgram (2005) and for preparing worksheets (average of 5.39; deviation of 1.31. The lowest use was in communicating with students via e-mail (average of 2.97; deviation of 1.91). The high rate of deviation in certain answers reflects the heterogeneous use of the teachers.

The teachers were asked if they integrated technological means in new ways from those learned in the training course. From the teacher's answers, we see that 81% of the teachers stated that they integrate technological means in new ways from those learned in the training course and 19% answered that they do not.

The interviewees pointed to the use of training course programs that helped them in their work in school. For example, the use of presentations that they learned in the training course was mentioned. One of the teachers described it by saying, "The computer presentation aids in the building of an idea

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and the planning of information". Another teacher described the understanding of a subject as an additional advantage of the use of presentations, "I built a presentation that shows the understanding of the movement of the body in various early stages. The presentation was more dynamic than the regular excel graphs".

There are certain fields of learning that are very hard to teach without presentations, like the field of art. "This is a main tool in art studies. I built attractive presentations and, expense-wise, my costs went down because I didn't have to buy expensive books. Everything is accessible and, when it's visual, everything looks much more impressive; the screen portrays everything in a much better way".

The Word program was used by the teachers mainly for the preparation of worksheets and tests. One of the teachers listed the many advantages, "Style has become an important factor in planning worksheets and tests. The spaces, borders and eye-catching illustrations help the students to absorb material faster. There's no need to exert yourself and worry about making photocopies; the preparation of materials is easier". Worksheets are used by most of the teachers even in subjects where Word is a novelty, as one mathematics teacher explained, "The use of the computer helped me prepare aesthetic looking worksheets, especially when including formulas and sketches".

Many teachers used the Excel program for updating and tracking students' achievements. In addition, this program was a very useful tool in the science subjects for preparing projects. For example, one chemistry teacher noted that "I asked my students to organize the data that was shown in the experiment and to process the data in Excel". Another science teacher added, "There is a simulation which you download from the Internet, perform the experiment and fill out the form using graphs from excel for the matriculation exam".

The building of the school Internet site opened up opportunities to create a different learning environment which included advantages cited by a number of teachers: "We can upload work for the students, print worksheets and tests and, in this way, save time and lower costs". Another teacher described the advantage of learning in a different way as "there is more student involvement in the learning process in comparison to conventional frontal teaching methods. This kind of learning environment promotes learning outside of the classroom. I can communicate with my students even after school hours and it's a source of constant connection between my students and me".

In addition, the computer programs make it easier for the teachers to correctly use the programs already in use in the school. These programs are "open" as opposed to the school programs which are usually "closed" and are geared towards specific topics such as physics and mechanics.

3.3 The Influence of Computerized Instruction on the Students

In the questionnaire, the teachers were asked to indicate how they integrated computerized instruction in the classroom. The scale of values had 6 levels where 6 was "a great deal" and 1 was "not at all".
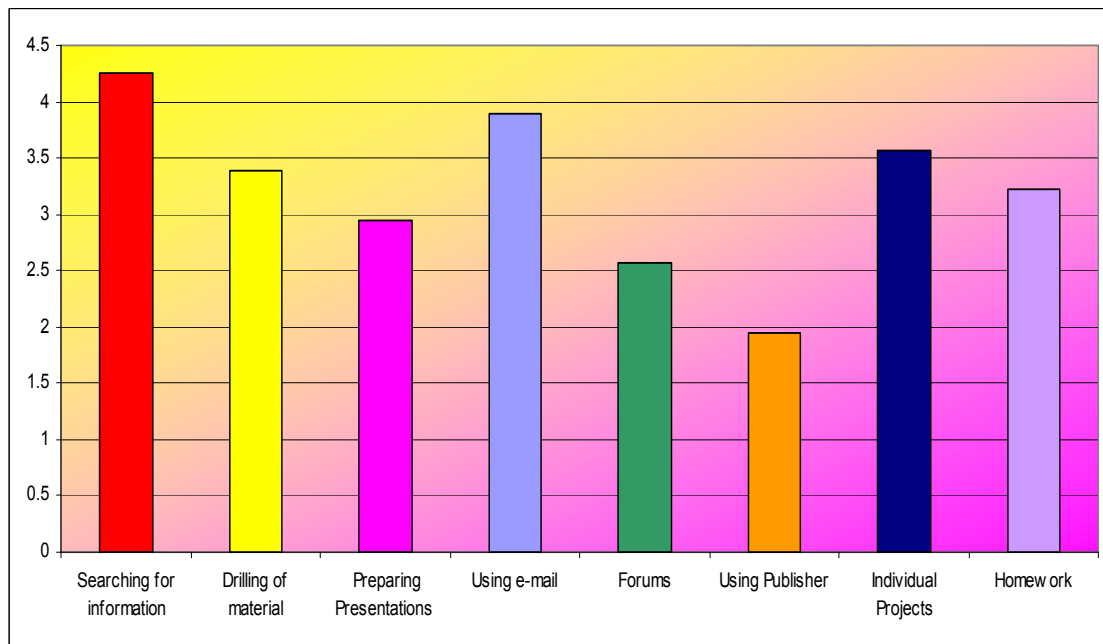
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Figure 3. The Use of Computerized Instruction in the Classroom (Average of Answers of the Teachers)

From Figure 3, we can see that the scale of averages range from high to medium-low and moves between an average of 4.26 to an average of 1.94 (on a scale of 6 levels). In general, when looking at these findings, we can see that the use of computers is in the medium range for a large number of areas: for drilling material (average of 3.38; deviation of 1.65), for using e-mail (average of 3.89; deviation of 1.92), for individual projects (average of 3.56; deviation 1.73), for homework (average of 3.23; deviation of 1.65), for preparation of presentations (average of 2.94; deviation of 1.76) and for the use of forums (average of 2.57; deviation of 1.79). The highest use by the students was in searching for information in the classroom.

The teachers were asked about integrating computers for homework. 66% of the teachers answered that the students use their home computer for preparing homework and 32% answered that they do not. This result shows the wide use of computers for homework. 34% of the participants answered that the students prepare their homework with the help of computers in the municipal computer rooms, the municipal library or the community center; 65% said that they do not.

As we can see from Figure 3, the teachers integrated individual student projects (average of 3.56; deviation of 1.73) in a mid-range level. In the interviews, however, it was easier to reach more in-depth knowledge about the computer integrated projects. The teachers noted that, as a result of the training course, they received tools that opened up opportunities to create projects with the students. These tools created a supportive teaching environment and simplified the creation of projects. In each school, there were unique projects that integrated the computer in the learning process, such as English projects in 12th grade and "research learning" in grades 7 and 8. Some examples of projects given by the teachers

were: "In class we are learning about values that involve man and his fellowman, for example, tolerance. One student built a power-point presentation that defined the value using examples from the football field and from the street".

In the subject of English language studies: "Every student needs to choose a topic in which he will present a research question. In order to answer the question, he must search for the information on the Internet. He must summarize the topic in Word and make a presentation in Power-Point".

In the questionnaire, the teachers were asked to list the positive influence of integrating technological information in the classroom.
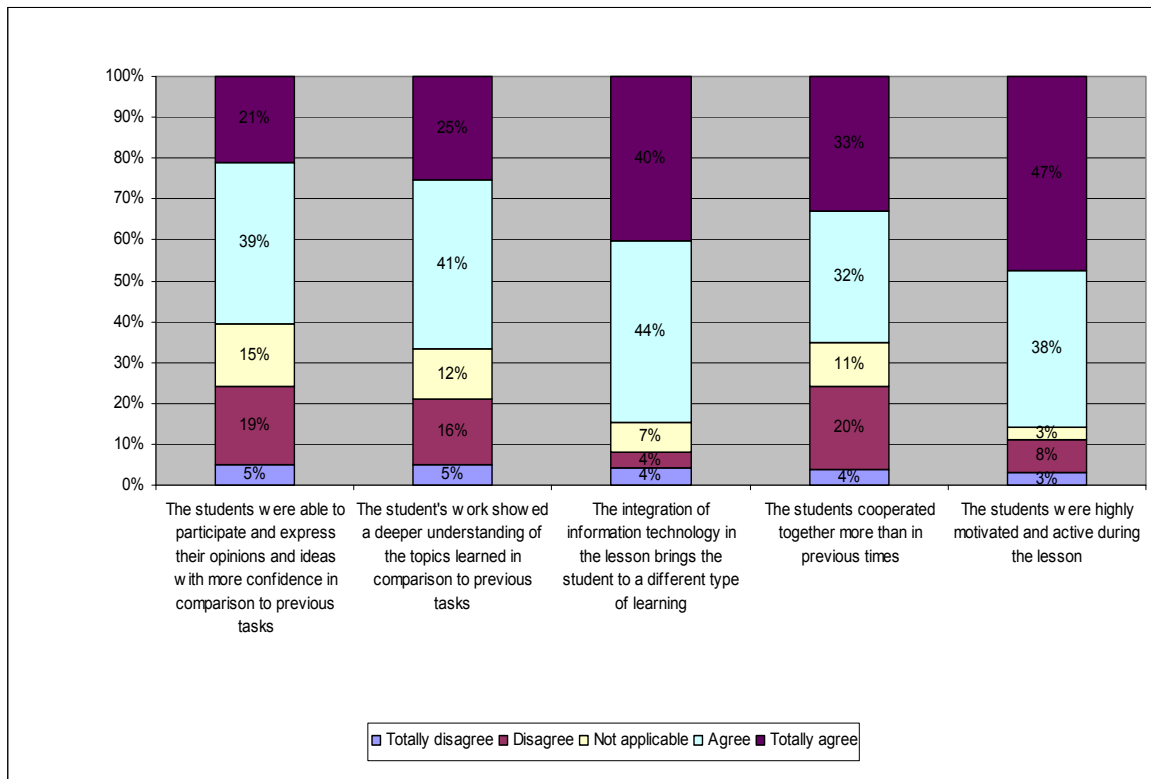

Figure 4. The Positive Influence of Integrating Technological Information in the Classroom

The teachers cited 2 main advantages of integrating technological information and computers that influence the students: The students were highly motivated and were more active throughout the lesson (85% answered "agree" and "totally agree"). Technological information that is integrated in the lesson leads the students to a different type of learning (88% answered "agree" and "totally agree").

These findings show the importance of integrating technological information in teaching since it creates a positive change in the learning process of the students. Most of the teachers interviewed mentioned the fact that the use of computers for learning raised the motivation of the students, improved the understanding of the material, brought variety to the teaching methods and served as a positive influence in the lesson. In the interviews, we heard comments such as these: "The computer is magic. The interest of the student in computers, compared to regular learning, is amazing". "The

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understanding of the material is much better". "The responses of the students are wonderful. Every child has a computer at home and they feel at home with it".

One of the teachers learned a lot about the use of computers from a survey she carried out among her students: "I did a survey and the responses were positive. This gave me the confidence to continue and develop more topics and learning units". "The participation in forums, as a learning tool, enriched both them and me. There was a mutual contribution and we received different and varied opinions that were both flexible and accessible…"

3.4 Difficulties in Integrating Computerized Instruction

A list of possible difficulties in integrating computerized instruction was presented to the participants. They were asked to rate the difficulty on a scale of 1 to 6 where 6 was "very difficult" and 1 was "not at all difficult".
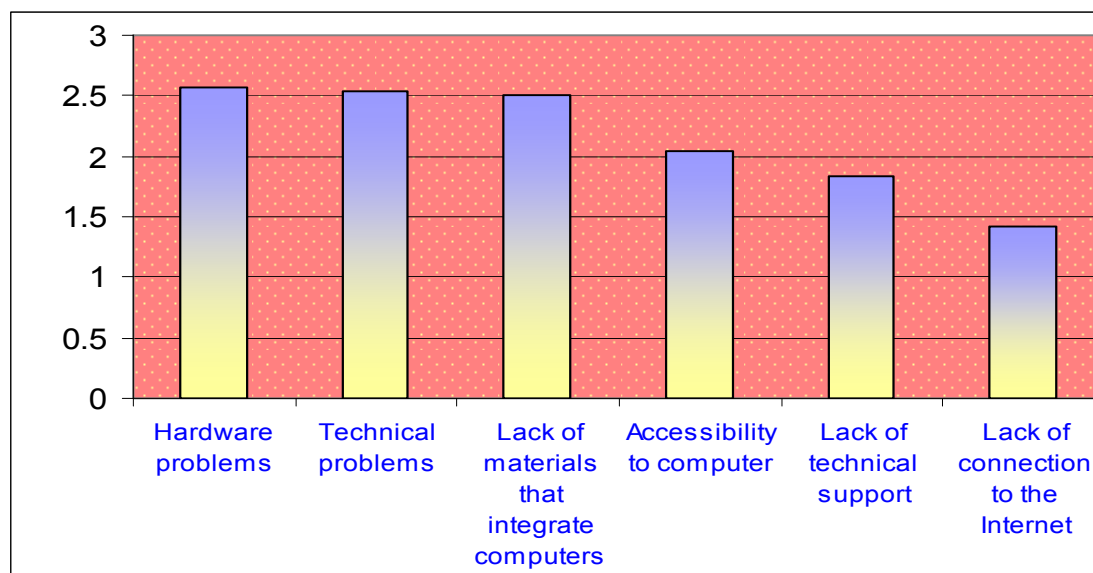

Figure 5. Difficulties in Integrating Computerized Instruction in the School

From Figure 5, we can see that the range of averages is from "not at all" to low-middle and ranges from an average of 1.42 to an average of 2.57 (on a scale of 6 levels). In general, it can be said that the participants did not encounter many difficulties. The main difficulties reported by the teachers were hardware problems (average of 2.57; deviation of 1.30) and lack of materials that integrate computers (average of 2.5; deviation of 1.57). The participants seldom encountered a problem with internet connection (average of 1.42; deviation of 0.72). Forty percent of the teachers said that they did not encounter any difficulty in planning a time schedule for the computer room.

4. Discussion

This study presents research whose purpose was to examine the influence of the training course, Intel Education for the Future, on teachers and on the degree to which they integrated the skills learned in their instruction in the classroom.

The first significant finding that emerged was the influence of the training course on the teachers and on their personal knowledge. The attitudes of the teachers underwent significant changes such as, "the feeling of mastery of the computer" and the lack of fear of using the computer. These results indicate that the special structure of the modules that were learned in the training course enabled the teachers to internalize the use of technological means and encouraged the experimentation with new ways of integrating the computer into the teaching process.

Hebenstreit (1985) and Yaghi (1996) also claimed that the more the teacher learns about computers on a wider scale, with attention to specific subjects, directed toward the teaching profession, the more he will integrate the computer in his classroom

The second significant finding was that the majority of teachers claimed that the training course resulted in a change in their teaching. The teachers became confident in using the computer as an additional tool of instruction in such areas as administrational functions, the use of presentations, the building of websites and the design of new lesson plans that integrated technology.

Cuban (2001) was another who noted that there has been a rise in the use of computers in the classroom thanks to the accessibility of the computer, the training of teachers and the policy which encourages computer use. Computer use is reflected mainly in the following activities–Using the word processor for writing, building presentations, searching for information on the web, and the use of e-mail. In addition, the researchers claim (Morris, 1992; Hatfield, 1992; Steen & Taylor, 1993), that the courses that are taught to the teachers must emphasize the fundamental change in the role of the teacher, in the transition from conventional teaching to computer-based teaching.

The third significant finding was the influence of integration of computers on the students. The teachers commented that the use of computers for learning increased the motivation of the students to a significant degree. Research supporting this finding can be found in Wasserman and Millgram (2005).

Findings from a study that was conducted regarding the impact of technology on learning showed that the most obvious change amongst the students was an improvement in their motivation. And Reynard (2009) adds that the online environment is not necessarily intended to improve their learning achievements but rather to improve their learning experience and in a greater sense their thinking skills.

Finally, it was found that the majority of the teachers experienced very little difficulty in implementing computer technology. A study that was conducted in a high school in Norway (Wikan & Moister, 2011) found that the majority of teachers used online education in the course of their teaching.

Results showed that the training course whose specific focus was the integration of the computer in the classroom influences the participants. Teacher training in the use of the computer results in integration of the computer in teachers' work and in their teaching. As research has shown, the key to correct

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integration of the computer for instruction in the classroom is dependent upon the teachers' attitude and the training they receive (Almog, 1997; Becker, 1994; Glennen & Melmed, 1996; Netz, 1988; Woodrow, 1989).

According to this, teachers must assume the central role in implementing the process of change through action. They must take on the role of mediator and become responsible for integrating the computer in their ongoing teaching. In order for them to undertake this task, they must enter into a process of learning, internalization and implementation. In a similar fashion, the teachers who participated in the research of OTA (1995) reported that one of the major factors that influenced optimal integration of technology in instruction was the training that they received that focused on familiarity with the computer tools and their use.

From this study, we conclude that there is a need to expand the knowledge of teachers in this subject and to offer more teacher training courses that focus on information technology in the classroom in order to promote the benefits that the computer has to offer for classroom instruction.

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