

Science Teachers' Perceptions and Attitudes towards the Integration of Digital books in their Classes

Raed Zedan¹

¹Advanced Learning, Academic Arab College for Education in Israel, Israel

RESEARCH

Abstract

This qualitative research study focused on science teachers' perceptions and attitudes towards the integration of digital books in elementary and junior high schools. In order to examine this subject, interviews were conducted with 138 teachers. The results emphasized the positive contribution of digital books to science teaching. The interviewees indicated that integrating this material presented a professional challenge, but listed a large number of advantages: introducing such books encouraged investigation, increased motivation, and improved learning achievements. At the same time, they had reservations and were convinced that there were also disadvantages, as some learners and teachers did not easily become accustomed to integrating digital books into lessons. An important matter raised by the teachers was the contribution made by integrating digital books to classroom climate during the lessons, thus the majority of the teachers indicated that they created a positive, comfortable, supportive, and cooperative atmosphere. They also stated that the learners maintained good relations among themselves and with their teachers and enjoyed and were satisfied with the lessons conducted by means of digital books.

Keywords: Digital Book, Science Teachers, Perception, Attitudes

1 Introduction

The digital book in its various forms (eBook, Electronic Book, Dynamic Book, Digital Book, Talking-Book) is a book in a digital format that includes information provided by a number of digital methods and is accessed by an assortment of technological means, it constitutes a rising trend towards the future [1]. At times the digital book is an electronic parallel to the printed book, while in other cases it stands alone. As opposed to the printed textbook, which includes permanent content that cannot be changed or updated, the digital textbook enables the learner to access rich and dynamic media, while providing him or her with a significant and relevant interactive experience [2, 3].

The digital textbook is based on the Ministry of Education's formal curriculum for various disciplines. It is accompanied by an instruction manual that serves as a guiding tool for the teacher and enables maximal exploitation of the digital content [3]. The digital book is characterized by providing accessible educational information at any place and time when it is possible to present a variety of media (text, pictures, films, applications, etc.); it creates an interactive environment that provides feedback and evaluation, a diverse environment that enables interdisciplinary learning [3, 4]. It also includes the possibility of constant updating and expansion of information and learning activities [5]. By using of these books, the learning content becomes more accessible and adapted to differences among learners [2, 6]. The digital book enables quick updating of existing information, thus remaining relevant in a constantly changing reality. It also makes it possible to adapt teaching processes to differences among learners, for example: adaptation to different cognitive abilities and learning styles, multiple intelligences, and a variety of fields. In addition, the accessibility and availability of the information contained in the digital book constitute an

OPEN ACCESS

Volume
13

Issue
1

Submitted 2 Jan 2021

Accepted 4 Oct 2022

Citation
Zedan R. "Science Teachers' Perceptions and Attitudes towards the Integration of Digital books in their Classes," *Computers in Education Journal*, vol. 13, no. 1, 2022.

advantage over the printed textbook regarding the utilization and search for information and learning materials [5, 7, 8]. Furthermore, the digital book enables the teacher to constantly track the students' learning processes, including their progress in the material [9, 10]. Digital books generally include verbal or textual feedback at various stages of the learning, the purpose of which is to enable the direction of thought processes and promote optimal learning. In addition, using a digital book enables self-directed learning, including applying critical thinking and drawing conclusions [11].

2 Literature Review

Several studies [1, 4, 6] support the effectiveness of digital learning in class and its influence on students' long-term achievements. In this process, the teacher is perceived as creating change and connecting between students' individual learning and the digital lesson-taking place in class [12]. In addition, according to Greenfield [10], digital teaching encourages cognitive processes, including searching for information, informed reading of data, organizing and analyzing data, writing, direction, sharing information among learners and on-line class discussion.

Science teaching by means of the digital book crystallizes teachers' perceptions and attitudes, which are likely to have an impact on effectivity and contribute to adopting and integrating the digital curriculum for advancing learners' levels and raising their achievements [13]. Despite the many advantages of advanced technology and its integration by digital means, teachers experienced in up-to-date teaching do not necessarily have the skills to include technology for advancing teaching goals. The use of technology to advance teaching demands specific knowledge, including the integration of three types of expertise: content, pedagogical, and technology numerous refresher courses that will enable them to acquire these three types of expertise [14].

The teacher's role in a technological age is not merely to present learning material, but also to guide learners and instruct them in the exploitation of the rich and plentiful material they possess, as well as directing them towards research and towards learning suitable to their individual styles. This process diverges strongly from traditional instruction [15].

In traditional education, the teacher was viewed as the sole provider of information to the student; he or she formally presented learning content, thus making it difficult for learners to actively participate in the lesson and demonstrate creativity regarding acquiring knowledge and analyzing it or understanding it effectively [16].

Research performed by Israel Ronen, Kalderon, & Shaham [17] indicated that in order to develop teachers' skills in the field of digital learning, they must take part in refresher courses and professional training that focus on digital learning and are in step with teachers' abilities while taking into account some professional and individual variables. These might include their role in the school, the subject they teach and their seniority. In other words, individual teachers differ from their peers regarding their attitude towards digital teaching and its possible contribution to advancing learners. This research study also indicated that technology can only provide tools; it does not guarantee learner success. The effectiveness and benefit of the product that is meant to activate learners will be determined by the content that the teacher pours into it and whether the learning activity is tailored for the class. While the technical skill to manipulate a tool is essential, it is not sufficient in order to ensure the pedagogical benefit of the product [6, 17].

Alongside the forces encouraging teachers' introduction of digital learning in class, the findings of Avidov-Ungar and Amir [19] related to an important factor for professional and efficient digital learning in schools, namely, teachers' development and professional learning as a source of preliminary support for such learning. This can not only broaden the teacher's abilities and skills in preparing digital lessons, but can also contribute to advancing significant learning in class and meeting learners' needs [13].

The results indicate that most teachers utilize technology as an addition to existing teaching-learning and do not implement more profound changes beyond traditional teaching towards advanced digital teaching-learning. Therefore, the need for appropriate training in employing

digital media is vital in order for the teacher to be professionally capable of integrating digital content in a manner that is understandable and enjoyable for learners [20]. Fullan [21] is convinced that correct and efficient implementation of digital teaching in classrooms will be possible only on condition that teachers' talents are developed by understanding and being aware of computerized content or digital books. Despite the declared policy of introducing computers into education, it appears that many teachers have not assimilated computerization as an inherent element in their teaching disciplines [19].

The effectiveness of integrating digital tools in education has been examined in several studies [22, 23]. Their results indicated that every learner has the possibility of creating an individual digital learning environment if guided and accompanied by his or her class teacher; the latter can guide and assist each learner in developing unique learning abilities, despite any difficulties he or she must cope with. The fact is that he or she is exposed to a new, unfamiliar learning environment. The use of the tablet computer, for example, as a tool for adapting learning to the needs of the student, is likely to assist in making it more accessible and relevant. It may be assumed that this trend will become stronger the more widespread the use of the tablet among teachers and learners [24]. In addition, studies [25, 26] have shown that introducing laptop computers in education encourages active learning, advances motivation and improves achievement in core subjects.

Factors influencing the introduction of digital books into the classroom

According to the claim of Meudosser, Nahmias, Tobin, & Farkush [27], it is possible to divide the factors influencing the integration of educational technology in the form of the digital book into two main categories: (1) organizational and administrative factors: the school's structural and operational organization; an easy approach to teachers and learners; pedagogical support on the part of the school administration, as well as technical accompaniment and support; adaptation of infrastructures and peripheral equipment; (2) factors directly connected with the teachers; the school principal's professional expertise; the teaching staff and their belief in introducing and assimilating pedagogical change; the presence in the staff of educational vision, communal goals and the impetus for advancing change.

Thus, teachers' beliefs have a considerable impact on their decision-making and teaching and learning methods. Meudosser and others [27] claim that integrating digital teaching and its effectiveness in class are influenced by teachers' beliefs, under the assumption that these teaching methods are likely to improve their teaching and professional development. Teachers' attitudes, then, express their perceptions and beliefs. The chances of utilizing computerized means increase considerably if teachers demonstrate positive attitudes towards computers and are acquainted with their advantages [27]. Nevertheless, other research studies have indicated that many language teachers in schools still avoid utilizing digital means, although they are capable of improving skills and writing abilities [13].

The objectives of the study

The purpose of this qualitative study is to examine and describe the science teachers' perceptions and attitudes towards the contribution of digital books into science teaching and to examine and describe the difficulties and challenges that they encounter and must deal with during science lessons.

The questions of the study

To achieve its objectives, the study attempts to answer the following question:

1. What are science teachers' perceptions and attitudes towards the contribution of digital books to their teaching methods?
2. How is the teachers' process of professional development related to their perceptions and attitudes towards the contribution of digital books to teaching?

3 Methodology

The present study adopts a qualitative approach and was conducted at elementary and junior high schools in the Arab community in various locations in the State of Israel during the year, 2020.

The research population

The research population comprised a sample of 138 science teachers, who were requested to participate in an in-depth, semi-structured interview that examined perceptions and attitudes towards learning by employing digital books in education.

Research tools

The present research employed an in-depth, semi-structured interview that was conducted with 138 science teachers. The questions were formulated in order to obtain information relevant to Arab science teachers' perceptions and attitudes towards the contribution of the digital book to advancing the curriculum and the learners' achievements. The interview questions aimed to examine if the interviewed science teachers were prepared to perceive the integration of the computer in the class as effective for the lesson plan.

Besides, the questions also aimed to examine the importance of professional development as a process that could contribute to strengthening the teacher's status, alongside the advantages and disadvantages of integrating the digital book in teaching according to their perceptions.

The questions focused on positive and negative attitudes towards utilizing computerized teaching in the form of the digital book. Some questions are written in the question form while others are written as polite requests. Here are some samples of the interview questions:

1. Please, tell me about the teaching methods applied in your school, how do you evaluate them.
2. What do you think are the unique characteristics of e-teaching and integration of digital book?
3. Please explain in detail the differences between a teaching method that incorporates a digital book and other teaching methods.
4. How does integration of a digital book affect your relationship with your students and the classroom climate in general?
5. Does e-teaching promote the student's achievement?
6. What are the pros and cons of learning/teaching by digital book?

These interview questions, which are related to the research topic, were developed and formulated according to the relevant information that was planned to be drawn from the research participants, and were based on previous studies in the field.

The researcher interviewed the participants individually. Some of the interviews with the teachers were conducted in the schools by prior arrangement, and some were conducted in places outside the school, also by prior arrangement. All interviews were conducted in a comfortable environment, without any conditions and with the assurance of rules of ethics and confidentiality and anonymity.

4 Results

Results of interviews with the teachers

The teachers were requested to describe in depth their perceptions and attitudes as science teachers towards the contribution made by integrating digital books in their lessons. The findings are presented according to the categories that emerged from the analysis of results according to a three-phase coded method and the research questions.

Nine main categories emerged from the interviews according to which the results are presented. Each category includes a number of replies and statements as reported by the interviewees. All the participants' statements were integrated, i.e., statements that were similar or close in meaning were formulated into one statement. All in all, 58 representative statements were obtained, which were sorted into Nine Categories that consists of 58 statements that appear on Table (1) appendix document.

- Category (A) The teacher's role as guide, moderator and accompanier.
- Category (B) The teacher's professional development and computer upgrading.
- Category (C) Deficiencies and difficulties regarding learners' preparedness.
- Category (D) The teachers' preparedness to integrate digital media
- Category (E) The teacher's skill and control over computers and integrating digital media;
- Category (F) Cooperation, assistance and support
- Category (G) Advantages of the methods and their contribution to learners
- Category (H) Physical environment and infrastructure;
- Category (I) Classroom climate

The results that are presented in the table are based on the teachers' replies and indicate that most of them (about 90%) believe that the teacher's role in a teaching method that integrates digital books is to be a guide, moderator and accompanier. He no longer constitutes a source of information and its controller, as he was in methods that did not include digital books, where the teacher was the supreme authority in the process of constructing information and teaching. It was possible to observe that integrating the digital book in teaching brought about a significant epistemological change in the process of knowledge construction. This was no longer done by means of adhering to an external source, but rather by independent learning and scientific inquiry.

Regarding professional development, the teachers stated that methods integrating digital books constituted a challenge. They were convinced that it is important to organize refresher courses that could guide and train them in the integration of computers and digital media such as digital books in teaching, as well as constantly updating them. This indicates the primary importance that the teachers give to digital teaching tools and the learners' need to be independent in accordance with up-to-date learning methods. Thus teachers cannot be seen to lag behind their students, who have control over digital media and technology.

At the same time, the teachers were convinced that there are both advantages and disadvantages to integrating the digital book in their teaching and expressed some reservations about the method. For example, some learners might not immediately be capable of working with digital books and might lose concentration and diverge from class discipline. As a result, the teacher might lose control of the class during the lesson. The teachers were convinced that one of the failures of the method is that the learners are cut off from one another, as each of them is immersed in his or her individual screen. In addition, some of the learners arrived without their laptop computers, in addition to difficulties experienced by some of them with reading from the screen, due to inconvenience or health reasons, but these would be in the minority. Learners' surfing irrelevant websites during the lesson could also constitute a disadvantage of the method. An additional important disadvantage was the inability of the method to emotionally contribute to the learner. Quite the opposite: there was a certain lack of contact, as each learner was working alone opposite the computer and the teacher might be unaware of what he or she is experiencing or feeling. Such aspects might not promote classroom climate and might even result in a certain degree of alienation.

The teachers claimed that they were prepared and able to integrate digital books and capable of implementing the method, but veteran teachers might have a problem integrating computers in general and digital books in particular. Research indicates that younger teachers are more open and willing to integrate technology into learning than veteran teachers. In addition, the teachers

indicated that they have the skills necessary to implement digital media and half of them stated that they have adopted and applied a variety of teaching strategies (films/simulations/computerized work pages). However, they were concerned about having less control of these applications than their students.

The teachers mentioned a number of advantages for their students to integrating the digital book in their lessons such as: the digital book represents a wide range of information, encourages investigation and includes visual and auidial effects, while increasing both motivation and learning achievements. The method is experiential, makes it easier for the teacher by illustrating concepts and learning activities. The interviewees indicated that the method is accessible and available, while developing creative thinking and arousing curiosity. In their opinion, it is definitely suitable to the new era. It helps to construct and develop knowledge, while the main contribution is expressed in the cognitive aspect that develops as a result of presenting the material by means of visual and auidial aids. In addition, the method is characterized by a high level of reflexive, critical thinking, and thus, it increases learning achievements.

Regarding the physical environment and the infrastructure necessary in the school in order to implement the method of integrating computers and digital media, the teachers strongly emphasized that their schools were well-equipped and prepared to implement the method regarding laboratories and computer stations, internet networks and everything necessary regarding infrastructure and logistics. They believe that the number of learners participating in digital lessons must be relatively limited.

A very important topic that the teachers clearly and specifically mentioned was the classroom climate that is prevalent during lessons including digital books. Most of them described a stress-free, positive, comfortable, supportive and cooperative atmosphere. Learner-learner and learner-teacher relations were positive and learners expressed their enjoyment and satisfaction during the lessons that included digital books. Thus, it is possible to determine that integrating digital books promotes a positive classroom climate in which each learner is involved in his or her own assignment, but there is a certain degree of cooperation and mutual assistance, a lack of tension and a high degree of satisfaction. In addition, there is a sense of equality on the part of the teacher, who takes into consideration the different levels among the learners.

5 Discussion

The present research study investigated the perceptions and attitudes of science teachers towards the contribution made by integrating digital books in their classes in elementary and junior high schools. The study was conducted according to a qualitative paradigm using an in-depth semi-structured interview. The teachers' replies were sorted and consolidated into 59 statements that were then divided into nine categories.

The method's contribution to advancing learners

The teachers indicated that integrating the digital book contributed to advancing their learners and increasing their achievements. This was due to the method's characteristics and its contribution to the learning process, including empowering learners and turning them into independent investigators. It also raised learners' motivation due to computerized learning, which they found enjoyable and exciting. Introducing simulations, films and games made digital learning even more effective. This finding is supported by Traxler's [28] claim that learning by means of laptops can contribute to a range of content to which the learner is exposed, thus causing him or her to advance. Over time this can cause a change in learning perceptions and how the learner creates contact with people and ideas [28]. Additional support for the present research may be found in studies by Grimes and Warschauer [25] and [26], who demonstrated that integrating portable computers into teaching encourages active learning, increases learners' motivation and improves their achievements in core subjects.

The teacher's role in implementing learning method s integrating digital books

The research results indicated that the teacher's role is decisive in successfully implementing methods integrating the digital book, as they emphasized that the teacher puts it into action and directs its application. It is the teacher who selects the learning content that will be conveyed in the lesson, prepares the classroom for the computerized lesson, guides learners in the use of the laptop, secure surfing of the Net, etc. The teacher's role shifts from a supplier of information to a guide and moderator, as opposed to traditional education, as described by Manny-Ican et al. [16], according to which the teacher was the sole source of information.

It is important to indicate that integrating the digital book in teaching brought about a significant epistemological change in the process of knowledge construction. It no longer was constructed by being derived from an external source, but by means of independent learning and scientific investigation.

Fullan [21] also indicated that the teacher fulfills a different role from that of traditional teaching. He is convinced that correct and efficient assimilation of computerized teaching in class will only be realized on condition that the teacher upgrades his or her role in managing the digitally-based lesson. This will come to expression both in selecting computerized content or digital books. In this process, the teacher is perceived as an innovator who forms a link between the pupil's personal learning and the computerized lesson presented to the class [12]. In their study, Burden et al. [24] also emphasized the directive and guiding role played by the teacher.

Teachers' attitudes towards integrating computers and digital books in science teaching

As a central factor in the process of teaching by means of the digital book, the teacher's attitude plays an important, even critical, role in the success of the method. The study results emphasized that the teachers expressed positive perceptions and attitudes towards integrating computers in general, and digital books in particular, in their teaching processes. They view computerization as an innovative learning method that forms part of up-to-date educational technology. Thus, their positive attitudes might have an impact on the school administration, which will, in turn, raise the teaching staff's awareness of the advantages of using computerized teaching methods and implementing digital books. These include lessening learners' need to carry heavy textbooks to school, while also affording them a real-time learning experience, including components and effects similar to the reality in which they live and function in the digital age. The teacher who adopts computerized learning becomes a moderator and guide for learners, thus strengthening social ties with the entire class, transforming him or her from the teacher as the classical source of knowledge to one who cooperates with the class, supports and assists them in acquiring new knowledge and assimilating it effectively and understandably.

These findings correspond to the findings of Meodosser et al. (2006), who discovered that integrating digital learning and its effectiveness for the class is influenced by teachers' beliefs. Additional support for the results of the present study may be found in those of Amir and Avidov-Unger [13], who indicated that science teaching by means of digital books crystallizes teacher attitudes and perceptions towards digital learning methods that are likely to influence their effectiveness and contribution to learners' achievements. However, it was found that veteran teachers had difficulties in integrating computerized learning and digital books in particular. Research [29] emphasized that younger teachers were more open to integrating these methods than older ones.

Professional development as an empowering factor in implementing the method

The research findings also related to the aspect of teachers' professional development as a condition for the successful integration of computerized learning by means of the digital book. The interviewees were of the opinion that it was still possible to teach according to traditional methods, but that these were no longer suitable to the new era, which has developed to the point where most of the educational system has adopted the computerized learning model. This is due to the availability and accessibility of digital tools and learning materials from various educational websites. Israel et al. [17] claimed that the efficiency of educational technology is not only to provide digital tools and materials but efficiency is also reflected in the content that the teachers themselves introduce and how they shape the classroom environment for cooperative activities among the learners themselves. Furthermore, teachers who are not conversant with activating

and implementing websites or preparing digital lessons will also find it difficult to improve their personal skills, for example, registering or evaluating learners on the school's website. These findings support the results of Manny-Ican et al. [16] that emphasized that the teacher's role in a technological era is not only to present learning material but also to guide the learners, direct them and raise their motivation level to learn to develop independence and instill investigative skills. Peled, Blau and Greenberg [18] also stressed in their research that the teacher must acquire technological skills, which are a condition for active assimilation of the technological material and raising learner achievements. Avidov-Ungar & Amir [19] clearly indicated that the teacher's professional development and advanced learning towards integrating digital teaching enhances his or her ability and skills in preparing and presenting digital lessons, resulting in the class making significant progress in the material.

Advantages and disadvantages of computerized learning by means of the digital book

While the findings of the present research study indicated that a computerized learning method by means of the digital book was perceived as extremely efficient for advancing learners educationally, socially and cooperatively, other positive factors emerged. The method serves to make the teacher's work easier by presenting the learning material through simulations that illustrate a broad range of concepts and information. In addition, it is appropriate for the new era, having an experiential dimension, being accessible and based on high-level thinking. It develops creative, investigative thought and encourages curiosity. The method also improves achievements and corresponds to learners' needs and their individual level. This also corresponds to Greenfield's (2012) study, which found that digital teaching encourages cognitive activities, such as searching for information, informed reading, organizing and analyzing information, writing, guidance, sharing information among learners and online discussions in class.

The Ministry of Education [2] also emphasized that the digital textbook enables the learner access to rich, dynamic media and provides a significant and relevant interactive experience. The digital book is characterized by presenting available educational information at any place and any time, which may be displayed in a range of media (text, picture, film, application, etc.). The findings of Sheehy et al. [11] indicated that the digital book provides an interactive environment that enables feedback and evaluation and a many-branched environment that enables inter-disciplinary learning. It also includes the possibility of constant updating and broadening of information and learning activities. By means of the digital book, learning content becomes much more accessible and suited to differences among learners. The content appearing in digital books may be quickly updated, making it relevant to a constantly changing reality. The teacher can also instantly modify the learning materials to be suitable to individual learners. The findings of the present research support other studies that emphasized that the digital book enables the teacher to constantly track pupils' learning processes and their progress in the learning content [9, 10].

Physical environment and infrastructure

The findings indicated that according to the interviewees, their schools possessed well-equipped computer laboratories with internet access, but some of them did state that their schools' budget was insufficient to create an infrastructure or acquire sufficient equipment for each class and student. In addition, peripheral equipment was lacking, as well as computer-controlling software. There was also some apprehension regarding ionizing radiation that was liable to cause visual problems.

Meodossier et al. (2006) stated that in order for the integration of digital teaching to succeed, certain organizational and managerial conditions and factors must be present, such as the school's structural and operative preparedness, classroom preparation, tables, and suitable equipment for operating digital media, easy access for teachers and learners and pedagogical support on the part of the school administration, as well as accompaniment and technical and pedagogical support, appropriate infrastructure and sufficient peripheral equipment.

Classroom climate

The interviewed teachers were convinced that the classroom climate prevalent in lessons inte-

grating the digital book was positive, supportive, and encouraging. Thus, there was no tension during the lessons, relations among learners were good, and also those between the learners and the teacher. The learners enjoyed and were satisfied with the way lessons including digital books were conducted. In other words, it appeared that introducing computerization and digital books contributed to fostering a positive classroom climate. Magen-Nagar et al. [20] stated that when the teacher implemented a digital content in an understandable way, the students would respond favorably. Other researchers [30, 31] supported these findings and emphasized the contribution of the digital book to the classroom climate and the learning atmosphere prevalent during the lessons.

6 Conclusions

The present study examined the perceptions and attitudes of Arab science teachers towards the contribution of the digital book to classes at the elementary and junior high levels. In light of this study and based on its results, the following are a number of conclusions:

- The computerized curriculum integrating the digital book is a method that aims at making significant changes in teaching methods. The facts presented by study participants indicate that this method has proven itself to be efficient and effective and that they recommend that all schools consider adopting it.
- The subject of professional training and refresher courses runs parallel with introducing computerized learning methods to the classroom. This raises the vital importance of advancing teachers and developing their skills by means of effective professional development that will contribute to their personal knowledge in a world of educational technology and will be of inestimable value to their students.
- The advantages and disadvantages of a computerized learning method differ from one teacher to another. While some of the teachers in the study reported less realistic disadvantages than others, the total sum of the reports regarding computerized learning was positive for learners. It was found to develop learners' horizons and expand their thought processes. When the school administration encourages the introduction of these methods, the teachers and functionaries in the organization perceive the subject of computers in the classroom to be part of a standard practice.
- The school administration and teaching staff are responsible for the success of computerized learning in the school. Learners are interested in learning in a comfortable, enjoyable atmosphere and computerized learning methods ensure that their needs will be met. But this is only on condition that all resources and accompanying equipment are available in order to create successful computerized lessons and progress towards significant learning in the school.
- Computerized methods are being implemented in schools with the aim of improving the quality of teaching processes and moving from traditional learning to learning that is more significant for teachers and learners alike.

By acquiring the correct skills for the use of computers and digital books, motivation to teach and learn will increase. Introducing computerization can create abstract, in-depth learning that is experiential, challenging and arouses curiosity, in other words, all the building blocks necessary for significant science teaching.

References

- [1] D. Prasetya, A. Wibawa, and T. Hirashima, "An interactive digital book for engineering education students," *World transactions on engineering and technology education*, vol. 16, no. 1, pp. 54–59, 2018.

- [2] Ministry of Education, "Innovative learning environments," 2012. [Online]. Available: https://www.liatpeled.co.il/?gclid=Cj0KCQiA1sriBRDARIsABYdwwE7hGb_bijlGemzsN6VAhNmI2_Sq-pgt7n-QnKNorNnflmMbhDA3i8aAseNEALw_wcB
- [3] Ministry of Education., "Students' usage of end means for purposes of learning," 2016. [Online]. Available: <http://cms.education.gov.il/EducationCMS/Applications/Mankal/EtsMedorim/3/3-6/HoraotKeva/K-2016-1-1-3-6-12.html>
- [4] A. Barana, M. Marchisio, and M. Sacchet, *Interactive Feedback for Learning Mathematics in a Digital Learning Environment. Education Sciences*, pp. 279–279, 2021.
- [5] U.S. Department of Education, Office of Educational Technology, "Reimagining the Role of Technology in Education: 2017 National Education Technology Plan Update," 2017. [Online]. Available: <https://tech.ed.gov/files/2017/01/NETP17.pdf>
- [6] B. Barron and C. K. Martin, "Making matters. A framework for the assessment of digital media citizenship," in *Makeology: Makers as learners*, K. Peppler, E. Halverson, and Y. Kafai, Eds., 2016, pp. 45–71.
- [7] C. Kahla, "E-learning is getting a boost with high-quality digital textbooks," 2019.
- [8] TeachThought, "10 Reasons Students Aren't Using Digital Textbooks," 2020. [Online]. Available: <https://www.teachthought.com/literacy/digital-textbooks/>
- [9] M. Nelson, R. Hains, and E., "E-books in higher education: Are we there yet?" *Educause Center of Applied Research - Research Bulletin*, 2010.
- [10] J. Greenfield, "For reading and learning, kids prefer E-Books to Print Books," *Digital Book World*, 2012.
- [11] K. Sheehy, R. Ferguson, and G. Clough, "Augmented education: Bringing real and virtual learning together," and others, Ed. Palgrave Macmillan, 05 2014.
- [12] S. C. Li and J. W. C. Pow, "The affordance of deep infusion of one-to-one tablet pcs into and beyond classroom," *International Journal of Instructional Media*, vol. 38, no. 4, pp. 319–326, 2011.
- [13] A. Amir and O. Avidov-Ungar, "What's blocking the integration of technology in teaching? The disciplinary barrier," in *The 12th Annual Education and Development Conference*, 2017.
- [14] A. Aflallo, "Contradictions in teachers' perceptions: The underlying barrier to integrating computer technology," *Dapim*, vol. 54, pp. 139–166, 2012.
- [15] B. Peled and N. Magen-Nagar, "Teacher characteristics in a computerized learning environment," in *Book of the 13th Conference for investigating innovations in learning technologies: The learner in a technological era*, Y. Eshet-Alkalay, A. Blau, A. Kaspi, S. Etgar, N. Gary, Y. Colman, and V. Zilber-Varod, Eds. Open University, 2013, pp. 3–12.
- [16] I. Manny-Ican, T. Berger-Tichochinsky, Z. Bashan, and A. Wolf, "Using laptop computers in class: Implications for teaching and learning," in *Book of the 13th Conference for investigating innovations in learning technologies: The learner in a technological era*, Y. Eshet-Alkalay, A. Blau, A. Kaspi, S. Etgar, N. Gary, Y. Colman, and V. Zilber-Varod, Eds. Open University, 2015, pp. 3–12.
- [17] R. Israel, M. Ronen, S. Kalderon, and H. Shaham, "Are we prepared for this race?" in *Book of the 13th Conference for investigating innovations in learning technologies: The learner in a technological era*, Y. Eshet-Alkalay, A. Blau, A. Kaspi, S. Etgar, N. Gary, Y. Colman, and V. Zilber-Varod, Eds. Open University, 2015, pp. 3–12.

- [18] Y. Peled, A. Blau, and R. Greenberg, "The impact of the model of a laptop computer for each learner on teachers' pedagogical perceptions and on the learning dialogue," in *Book of the 13th Conference for investigating innovations in learning technologies: The learner in a technological era*, Y. Eshet-Alkalay, A. Blau, A. Kaspi, S. Etgar, N. Gary, Y. Colman, and V. Zilber-Varod, Eds. Open University, 2015, pp. 3–12.
- [19] O. Avidov-Ungar and A. Amir, "What is delaying the integration of technology in teaching? The disciplinary barrier: The case of first-language (L1) teaching," in *Book of the 13th Conference for investigating innovations in learning technologies: The learner in a technological era*, Y. Eshet-Alkalay, A. Blau, A. Kaspi, S. Etgar, N. Gary, Y. Colman, and V. Zilber-Varod, Eds. Open University, 2018, pp. 3–12.
- [20] N. Magen-Nagar, A. Rotem, T. Inbal-Shamir, and R. Dayan, *The influence of the National Computerization Program on changes in teachers' practice*. Tel-Aviv: Hebrew, 2014.
- [21] M. Fullan, *The Moral Imperative Realized*. Thousand Oaks, CA: Corwin Press, 2011.
- [22] S. Ghavifekr and W. A. W. Rosdy, "Teaching and learning with technology: Effectiveness of ICT integration in schools," *International Journal of Research in Education and Science (IJRES)*, vol. 1, no. 2, pp. 175–191, 2015.
- [23] K. Ruthven, R. Schibeci, J. MacCallum, and W. Cumming-Potvin, "Framework for analysing the expertise that underpins successful integration of digital technologies into everyday teaching practice," in *Mathematics teacher in the digital era: an international perspective on technology focused professional development*, Clark-Wilson and R. Sinclair, Eds., 2014, pp. 373–393.
- [24] K. Burden, P. Hopkins, T. Male, S. Martin, and C. Trala, "iPad Scotland Evaluation," 2012.
- [25] D. Grimes and M. Warschauer, "Learning with laptops: A multi-method case study," *Journal of Educational Computing Research*, vol. 38, no. 3, pp. 305–332, 2008.
- [26] D. L. Silvernail and A. K. Gritter, *Maine's middle school laptop program: Creating better writers*, Portland, OR, 2007.
- [27] D. Meudosser, R. Nahmias, D. Tobin, and A. Farkush, *Pedagogical innovation integrated with information technology and communications*, Tel-Aviv, 2006.
- [28] J. Traxler, "Will student devices deliver innovation, inclusion and transformation," *Journal of the Research Center for Educational Technology (RCET)*, vol. 6, no. 1, pp. 3–15, 2010.
- [29] P.-S. Hsu, "Examining current beliefs, practices and barriers about technology integration: A case study," *TechTrends*, vol. 60, no. 1, pp. 30–40, 2016.
- [30] A. Mutalib, E. Azelin, M. N. Hezlina, M. H. Razol, M. A. Zullina, and H. S., "E-books as textbooks in the classroom," *Proceedings of the International Conference of Education Research, Cyprus. Procedia-Social and Behavioral Sciences*, 2012.
- [31] F. Lei, C. Ting-Wen, H. Ronghuai, and C. Wei, "A Framework of Teaching and Learning with e-textbooks in smart learning environment," *International Conference on Advanced Learning Technologies*, 2015.

Table (1): Presents the Analysis of Interviewees' replies according to statements and categories (N = 138)

Cat.	Statement	No. of Replies (%)	Total
A	1. The teacher is not the main source of information.	39 (28%)	123 (89%)
	2. In the previous method, the teacher was the information center and for every question or piece of information the learners would return to her in order to receive answers. Today there is no need to return to the teacher for information.	27 (20%)	
	3. The teacher still has a directive role.	31 (22%)	
	4. In computer lessons the teacher responsible for computerization guides the learners in the use of digital books.	26 (19%)	
B	5. The method provides the teacher with a challenge for self-improvement.	21 (15%)	110 (80%)
	6. It is important to hold school-wide refresher courses to guide and prepare teachers for integrating computer and digital media in teaching.	41 (30%)	
	7. The teacher must ensure the inclusion of computers and digital media in teaching and must constantly be updated.	48 (35%)	
C	8. Learners were not properly prepared and their adjustment to computerized learning was slow.	26 (19%)	130 (94%)
	9. The teacher loses control over the learners the moment they enter websites that are irrelevant to the lesson.	13 (9%)	
	10. The material displayed is not always sufficient. Sometimes there is a lack and sometimes there is irrelevant material.	15 (11%)	
	11. The method does not contribute emotionally to the learner. Quite the opposite – there is a certain detachment, as the learner works alone opposite the screen and the teacher is unaware of what he is undergoing or how he feels.	9 (7%)	
	12. The learners do not all have computers at home or available internet.	3 (2%)	
	13. The learners have a hard time learning independently and are liable to fail.	19 (14%)	
	14. A large number of learners do not bring their laptops and that interferes with planning the lesson.	19 (14%)	
	15. Sometimes learners surf irrelevant websites that are unnecessary for the lesson being taught.	35 (25%)	
16. Some learners find it difficult to concentrate or read from the screen.	10 (7%)		

Cat.	Statement	No. of Replies (%)	Total
D	17. The teacher is prepared and capable of integrating digital media and is up-to-date with the learning material.	39 (28%)	100 (72%)
	18. The teacher can implement a method integrating computers and digital media in which it is possible to overcome various problems such as a lack of computers and internet crashes.	24 (17%)	
	19. Veteran teachers had difficulty in integrating computers and objected to working with the method.	37 (27%)	
E	20. Made an effort to implement a variety of teaching strategies that contributed to implementing and integrating digital media and carrying out the computerized method (films/ simulations/computerized work pages).	69 (50%)	111 (80%)
	21. Complete lack of control on the part of the teacher over computerized content; the learners' abilities exceeded those of their teacher.	42 (30%)	
F	22. The method is characterized by group work that strengthens a social approach.	21 (15%)	78 (57%)
	23. Different methods promote cooperation and openness between learners and teachers.	24 (17%)	
	24. Cooperation among learners during classes (cooperative learning).	33 (24%)	
G	25. The computerized method makes it easier for the teacher. It presents learning information in simulations and experiments and presents everything before the learners' eyes and not only in their imagination.	3 (2%)	92 (67%)
	26. A wide range of learning information.	4 (3%)	
	27. A wide range of teaching methods, such as investigation and problem-solving, presenting questions and investigating problems, simulations and various experiments.	3 (2%)	
	28. A wide range of presenting information; gives greater responsibility and authority to the learner during the lesson. Information is presented in a clear and interesting way.	9 (7%)	
	29. More computerized lessons will contribute to upgrading and developing information available to learners. Supervision and feedback is possible throughout the entire process.	8 (6%)	
	30. The new technological method is suitable for the new age and brings learners closer to daily life.	2 (1%)	

Cat.	Statement	No. of Replies (%)	Total
G	31. The method contributes cognitively because it enables illustrating the learning material by including pictures and simulations.	2 (1%)	
	32. This method is experiential for learners with a lot of illustrations and with the possibility of sending tasks by computer.	5 (4%)	
	33. The method is based on high-level cognition and critical thinking. The advantage of the method is that it is easy to activate and implement.	5 (4%)	
	34. The method is accessible for every learner.	8 (6%)	
	35. The learning tasks are constructed in a manner suitable for either weak or strong students, who can participate in the tasks and attain achievements.	11 (8%)	
	36. It makes it easier for learners, who don't have to drag heavy books to school.	2 (1%)	
	37. The learner investigates and solves problems independently, so that his motivation for learning increases.	12 (9%)	
	38. Students' achievements increase.	3 (2%)	
	39. Every learner advances in the tasks at his or at her own pace and is a partner in selecting learning content and planning the learning environment and the time necessary for learning.	2 (1%)	
	40. The method develops creative, investigative thought and encourages curiosity.	4 (3%)	
	41. Computers assist learners in understanding the learning material, especially those who have problems with frontal instruction.	2 (1%)	
	42. ADHD or learning-impaired pupils enjoy learning by this method and it helps them to concentrate.	2 (1%)	
	43. Gifted learners experience self-realization and are provided with challenges.	2 (1%)	
	44. Some of the learners are reluctant to return to the textbook and writing down information in their notebooks.	3 (2%)	

Cat.	Statement	No. of Replies (%)	Total
H	45. The school infrastructure is prepared and the internet is available.	31 (22%)	135 (98%)
	46. Every class has available computer stations and the teacher's computer is connected to a projector.	28 (20%)	
	47. The school has computer laboratories.	51 (37%)	
	48. The school budget is not sufficient for building infrastructure or receiving sufficient equipment for classes according to the number of learners.	7 (5%)	
	49. Generally the number of students in the class is greater than the number of available laptops, so the teacher is forced to work with groups around one computer.	4 (3%)	
	50. There must be long-distance control over the learners' laptops.	8 (6%)	
	51. There are problems with overload on the internet so that it sometimes crashes.	6 (4%)	
	52. A large amount of ionizing radiation that could create visual problems.	3 (2%)	
I	53. There is no tension among learners during lessons.	14 (10%)	135 (98%)
	54. Teacher-student relations improved.	21 (15%)	
	55. An equal attitude towards all the learners in the class.	13 (9%)	
	56. Improvement in learner-learner relations.	27 (20%)	
	57. Provides answers for students on different levels.	24 (17%)	
	58. Enjoyment and satisfaction during the lesson.	36 (26%)	