Impact of Educational Software on Teaching Mathematics (Case Study of Application of Zambak Interactive Form)

Ahmet CAKIR*

Abstract

This article presents the results of a quantitative and qualitative research on the attitudes of students and beliefs of teachers about educational software prepared for mathematics lessons. It will be helpful for high school mathematics teachers as well as for researchers in the field of teaching mathematics. The aim of the article is to investigate the beliefs and attitudes of high school students and mathematics teachers about some educational software, including "Zambak Interactive Form" that is prepared for mathematics lessons. In the article, the following questions are answered: "What are the criteria for selecting or preparing an educational software for mathematics lessons?", "How are the attitudes of high school students about the educational software for mathematics lesson?" and "What are the beliefs and attitudes of mathematics teachers about the educational software and Zambak Interactive Form?" For the research part of the article, two questionnaires were developed by the researcher; one for high school students and another for mathematics teachers from 9 countries. Student's questionnaire searches the attitudes of students towards educational software. Teacher's questionnaire searches the beliefs of mathematics teachers about educational devices and software. It was found that the use of appropriate software and technological devices in education have a positive effect on the attitude of students in mathematics lessons. The administrators need to support their teachers to find or prepare effective software for their schools. Also, majority of the teachers are aware of the importance of using appropriate educational software.

Keywords: Educational software, criteria for selecting educational software, mathematics education, teaching mathematics.

Introduction

We living in space and technology age. The generation of this age needs to use technology as an integrated part of their lives. Kwiatkowska et al. (2007) and Lin & Tsai (2002) suggest that, if the learners cannot learn to use the technology in a correct way, it will have a negative effect in their future life. So, teachers need to use the technology effectively and teach its application to their students.

As we know, every technological device uses some software to process the commands. This software may be a general-purpose software that is used for many different areas or it can be specific software designed for only

* MA, Nikoloz Tsereteli International School, Tbilisi, Georgia.
E-mail: ahmetcak@yahoo.com

some special areas like teaching mathematics or teaching only numbers. Educational software is defined as a program that either tries to teach or offers a learning environment to the user. According to Atiker (2012), educational software is a tool that is prepared by using programming languages and used for teaching a specific lesson efficiently with the help of different digital materials. Güzeller & Korkmaz (2007) defined it as a lesson program that is formed by adaptation of teaching materials to computer environment. Durak (2009) added that they are also interactive, visual and attractive materials.

Milton (2002) stated that educational software includes the content of web sites, video on demand, broadcast material and an ever-expanding range of digitalized materials. We need to find some useful software for our technological devices, but it is not always possible to find the most efficient software for each topic. Because of this, finding or preparing the most appropriate software for mathematics lessons has a crucial importance for mathematics teachers.

Before deciding the most appropriate software we need to check that the hardware or devices are suitable for it. When we check mathematics classrooms of modern schools, almost all of the classrooms have a computer, more than 90% of them has a projector and more than half of them has a Smartboard. That means that computer-projector-Smartboard are at the moment the most suitable technological equipment for teaching mathematics. We may decide the type of the hardware, depending on the aim of the program. In some cases, we may use iPad, tablet PC, smartphone or also an e-book reader as a suitable hardware. Some applications, developed for Android or iOS programs, are very useful for self-learning. On the other hand, most of the software that we use for teaching mathematics are designed for computers and Smartboards. So, the most important thing is to define the aims of our software and the devices that we need to use that software on.

It is not always possible to find some useful software that satisfies all of the needs of the teachers and students. The greatest problem in selecting the software is the authors of the software. In general, computer programmers prepare the programs, and teachers use it. So, the aims and pedagogical bases of the user and author may be different. According to Bennett (1996), programmers can prepare software that will satisfy the needs of students only if computers are responsible for the complete education of students. It is impossible to prepare such software in this case. The U.S. Congress Office of Technology Assessment (1988) claim that there is a general consensus that most software does not yet sufficiently exploit the capacity of the computer to enhance teaching and learning. So, programming companies need to work with a team of teachers and computer programmers. Just in this case, they can prepare the most efficient software for teaching mathematics. Akpınar (2005) emphasized the importance of preparation team of the software.

One of the examples of such type of a team is formed by Zambak Publishing Company. They are selling their publications in more than 30 countries. When they decided to develop the software for their publications, they called one expert teacher from each subject and from each country where their publications would be sold (the researcher was one of them). They gave a training course to these teachers by professional programmers for two weeks. After that, the teachers learned how to use the software and then the company gave one book to all

participants to develop the tasks applying the software for that book. Until summer, teachers together with the Zambak programmers developed the software for their books, then they held another program in the summer for two weeks. In this program, the teachers explained their difficulties and the needed components that the programmers need to insert into / change in the software. At the end, they decided to make some changes in it. In that year, the software was piloted in some schools. During the winter holiday, they decided to add more functions to the software and continue in this way for two years. After that, the company signed a contract with the Oxford Publishing Company and they used this software in their books, too. That was a good example to say that efficient software must be developed in cooperation with teachers.

Criteria for selecting educational software

According to Yalın (2003), we need to evaluate the efficiency of the software before using it. Irvine (2003) suggests that the limits of using software as a teaching tool should be understood well before selecting the software. She also said that the way software or hardware is used and the environment surrounding the activity are as important as what just the software or hardware includes.

For this evaluation we need to define some criteria for selecting the software. Many researchers (Aşkar & Köksal, 1987; Nielsen, 2003; Feyzioğlu, 2006; Çelik, 2008; MEB, 2005; Todd, 2005) formed some criteria. We may sum up some of these criteria as follows:

- The software must be compatible with the curriculum and the aims of the lesson.
- The aims of the software must be decided and be clear and certain.
- The level of users must have specified on the program.
- There must be user's guide for teachers and for students.
- The documents or tools that will be used by the software must be specified.
- Prerequisite information must be represented.
- The software should be attractive for students.
- The software should use more than one sense of the students. It should include pictures, sounds, videos and other types of multimedia documents.
- The explanations must follow an ascending order.
- There may be different levels of explanations for different types of learners.
- The program must be compatible with the age, intelligence and socio-cultural status of the students.

Jackson (2000) said that there are two ways to select the best program: one is reading the guides to software and portals to websites and the second is to undertake your own assessment. In his assessment he used the items: Platform requirements, Goals and objectives, Content, Pedagogy, Ease of Use and Cost. Belyk & Feist (2002) defined their criteria as cost, complexity, control, clarity, common technical framework and features. Similar to these two researchers there are many others who decide their criteria about selecting software.

If we check the market, we can see thousands of different software and web sites, but which of them are really useful and which of them are waste of time? Educators (Yalin, 2003; Tanyeri, 2008) divide the educational software into five categories:

1. Repetition and practice software
2. Direct teaching software
3. Educational games
4. Problem solving and testing software
5. Analogy software

We can use some of these programs in classroom when we present our lectures, but the majority of them are prepared for self–learning. So, effective software should be convenient to more than one of these five groups of software. We may prepare software that can be used for practice, direct teaching and problem solving. If it includes some components like puzzles and games, it will be effective for our lessons.

All these criteria may be enough to select useful software for teaching, but if teachers write down their own criteria, they can find or even develop the most useful software for teaching their subject, in our case, mathematics. Because of this reason the researcher developed his own criteria to select or develop educational software and use it in preparation of Zambak Interactive Form.

1. Can we insert / change something? Much software is ready to use. Programmers prepare software that the user cannot make any change to. Good software should allow teachers to make some changes to it. In Zambak Interactive Form, teachers may develop their own activities and files, and then insert them to the program. Also, they can share these files with other teachers.

2. Is it useful for Smartboard? We know that Smartboard is a need for modern classrooms. Smartboard is the unique educational tool that involves all students in the educational process (Gillen at al., 2006). In developed countries, almost every classroom has a Smartboard. So, effective software must be compatible with Smartboards.

3. Is it used for teaching? The majority of the software on the market are designed for self-learning (Çeliköz & Erişen, 2007). If teachers want to use software in the class, it must be designed to help teacher to present the topics. It is easy to find software for learning any subject, but finding software to use for teaching is not so common.

4. Does it include multimedia? Leavitt (2006) claims that the effective use of visual effects and multimedia improve the quality of learning, because they help us to involve more students' senses in the education process. So, effective software should include different types of multimedia files, like videos, sounds, visual aids and other types of files.

5. Is it appropriate for the curriculum? As we know, curriculums of different countries and also different schools in the same country have many differences. Because of this, it is very important to find the most appropriate software for the curriculum used in the school / university. Good software should not include only the needed

minimum, because some of the materials may be necessary for some curriculums and some others - for another curriculum. Including more topics and materials increase the usability of the software in different countries and for different curriculums.

6. Is it attractive for students? According to Dix et al (2004), it is very important to develop software that is attractive and entertaining for students. It is not easy to guess if the software is attractive for a particular student or not. But if there are more competitive applications, games, puzzles, multimedia and visual aids, the software is more attractive for students.

7. Does it have everything in one place? Learners prefer flexible, individual and easy to access software. Andrews (2008) defined computer interaction as a criterion that investigates the usefulness of interactive software for users and he emphasized the importance of user interface of the software. In effective software there should be a dynamic screen. That means that it is possible to can reach all types of materials from the same page of the software just by clicking a button.

8. Is it ready to use? General-purpose software does not generally include any ready-made materials. Teachers need to develop the materials for that program. Good software should contain ready to use materials as well as enable teachers to develop their own materials / activities.

9. Does it include activities with feedback? According to Özkan (2005), effective software includes different types of activities, answers to questions, analyses of the solutions and some feedback. But many websites and programs have generally the same type of activities. Effective software must include different types of activities. Not only question-answer form, but also other activities like sliding, matching, true-false and puzzles are needed.

10. Is it free or expensive? This is the most important criterion of selecting effective software. One may reach many different software and websites, but they sometimes cost a fortune. When the cost of the software is discussed, it is necessary to include different things: internet access, technical support, hardware configuration, price of software, download properties, license fees for per user and system requirements. It is better to use free software, but free software is generally not very effective. Some software, like Zambak Interactive Form, are prepared for their books and given for free with the book. This is a very effective approach.

The majority of software have user's guide, and there is no need to have any extra skills to use it. Only some software requires to know some extra information and to having some extra skills. Nielsen (2003) claims that people do not like the software that is difficult to use and require much time to learn to use it and to use it.

Witfelt & Hansen (1999) suggest that, irrespective all obvious advantages, educational software has remained a minor medium in the classroom for some reasons: teachers' reluctance to use technology, lack of technical training, lack of assistance in choosing the software, time pressure, lack of resources and materials and technical

problems. Ehrmann (1999) claimed that none of the educational software guarantees to yield learning outcomes, but their methods of usage in lessons influence the outcomes. For this reason, cheap or free-of-charge, easy-to-use, involving various activities and feedback software must be selected and developed to remove all the barriers and should to be facilitator for the teachers.

Zambak Interactive Form

Zambak Interactive Form has been prepared by using these criteria. The aim of the program is to use the Zambak Publication books in interactive form. The software is designed to present lessons on a Smartboard. It is prepared in such a way:

- Easy to use for teachers and students,
- Students may also use it for self-learning,
- There are all types of multimedia files (sounds, pictures, caricatures, videos, anecdotes, web links, visual aids and others),
- It uses a dynamic screen. By this, we can reach all types of the documents in the same window and the documents are placed to the pages which are exactly related to topics,
- Include more material than original books,
- Include a special testing program with a statistical result page,
- Include a lot of different types of activities and question types (like fill in the blanks, true-false activities, puzzles, drag-and-drop activities, and others).

Shortly, we can say that this program is prepared to help teachers to present an attractive lesson without using an extra effort.

In this study, several various software was used for teaching mathematics. Also, e-mails were sent to teacher groups and their ideas about software for teaching mathematics was taken into consideration. Before using it, it was assessed according to the above criteria.

The software includes some general-purpose software and some software prepared for mathematics. General purpose software is Microsoft PowerPoint and ActivInspire. Software used for preparing some mathematical activities, worksheets, competitions, and games are Derive, Geogebra, Mathletics, IXL Math, Khan Academy, Math Aids and Kutasoftware. Software used for teaching algebra are Zambak Interactive Form, Holt Mathematics, Learn for Success, and Smart Notebook. Webpages are Mathletics, IXL Math, Khan Academy, Math Aids, and Kutasoftware. The results of the assessment of the software are presented in Table 1:

Table 1: Criteria for Selecting the Best Software for Teaching Algebra

	Name of Software	Can we insert something	Useful for smartboard	Used for teaching	Include multimedia documents	Appropriate for the curriculum	Attractive for students	Everything in one place	Ready to use	Include different activities with feedback	Is it free
1	Zambak Interactive Form	√	√	√	√	√	√	√	√	√	√
2	PowerPoint	√	x	√	NA	NA	√	NA	x	x	√
3	ActivInspire Smartboard Program	√	√	√	x	NA	√	x	x	√	√
4	Derive	√	√	NA	x	NA	√	x	NA	x	x
5	Geogebra	√	√	√	x	NA	√	x	x	x	√
6	HOLT Mathematics	x	x	√	√	√	NA	√	x	x	x
7	Learn for Success	x	x	√	x	√	x	x	NA	NA	x
8	Mathletics	x	x	x	NA	√	√	NA	√	NA	x
9	IXL Math	x	NA	x	x	NA	√	NA	√	NA	NA
10	Khan Academy	x	x	√	NA	NA	√	NA	√	NA	√
11	Smart Notebook	√	√	√	x	√	√	x	NA	x	√
12	Math Aids	x	√	x	x	√	NA	x	√	x	NA
13	Kutasoftware	X	√	x	x	√	NA	x	√	x	NA

In the Table 1, √ means that the program has the given property, X means that the software has not got that property, NA means this property is either not available for that software or that criteria cannot be evaluated for that software or that criteria not completely available for that software.

Teachers may use all software, sometimes one type and sometimes – another, for different reasons in the same lesson or during different lessons. But, using only one program at a time for teaching will be more effective than using a lot of different programs. Zambak Interactive Form is good as one may develop a lesson in some other software, but then insert it in Zambak. Because of this, we say that the most effective program that we have used is Zambak Interactive Form. Its power comes from the preparation team of the program.

Methodology

Quantitative research was held. Two questionnaires were applied; one for students and another for mathematics teachers. All participants were volunteers.

Student's questionnaire offered 15 items for assessment in a 5-point Likert scale. The participants had to assess the items as 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. To calculate the mean results, all points were multiplied by the number of students who gave the particular assessment, all results were summed up and the sum divided by the number of respondents. Let us imagine that 10 students answered "1", 5 students – "2", 12 students – "3", 7 students – "4", and 15 – "5". The calculations were: (10x1 + 5x2 + 12x3 + 7x4 + 15x5):59 = 2.69 (the result is rounded to hundredths).

The items dealt with students' attitudes towards technologies used for teaching mathematics. Some items were in direct format, while others – in inverted format (the idea was negated). It was necessary, to eliminate mechanical answering and not to lead the respondents to the answers desirable for the researcher. To calculate the students' attitude to the application of technologies (to see whether it is positive), the results for these items were reverted as well, e.g.

1) Direct item: Using software makes learning mathematics enjoyable. 26+29 of students agreed with the statement, 3 gave a neutral answer, and 2 disagreed.

2) Reverted item: Using technology in mathematics lessons makes mathematics more complicated. In reality 1+1 students agreed with the statement, 10 gave a neutral answer, and 30+17 – disagreed. But, to calculate the mean for the whole questionnaire, tom see, whether the students' attitude is positive (mean above 3 out of 5) the results of the reverted questions was reverted (47– 10 – 2 correspondingly).

The goal of the questionnaire for teachers was to find out teachers' ideas on technology application, their problems of software applications and to assess the software used. The questionnaire involved four open-ended and six check box questions. Then teachers' answers to each open-ended item were summarized and all results were analyzed.

Findings

For the first questionnaire:

59 high school students (10th graders) from Private Demirel College, Tbilisi, Georgia answered the questionnaire. A permission from the school administration was obtained, the 10th grade students were explained that the questionnaire is anonymous, its purpose is finding better ways of teaching and it will have no impact on their academic achievement and only those who volunteered filled out the questionnaires.

Table 2: The percentages of answers of respondents

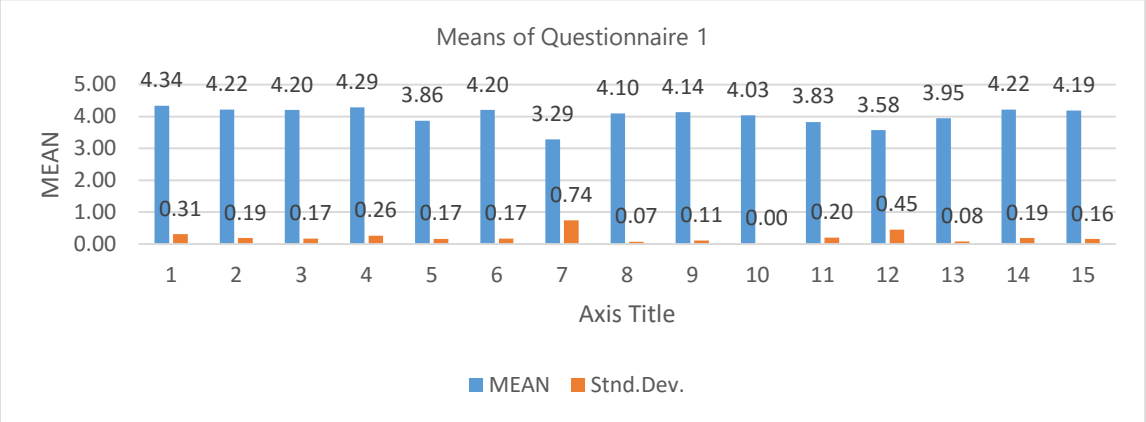
	Items / assessments / number of people who chose the assessment	5	4	3	2	1	mean	Variance
1	Using software makes learning mathematics enjoyable.	26	29	2	2	0	4.34	0.09584
2	Application of software during the lessons showed that mathematics is not as horrible as I thought.	23	28	6	2	0	4.22	0.03646
3	The applied software helped me understand mathematics better.	25	23	9	2	0	4.20	0.03027
4	I like the lessons that integrate technology.	23	31	4	1	0	4.29	0.06694
5	If all teachers use the technological devices, the school will be an enjoyable place.	15	29	8	6	1	3.86	0.02722
6	*Learning mathematics with games and jokes make it useless.*	1	1	7	26	24	4.20	0.03027
7	*The exams held with technological devices are harder than classical on-paper exams.*	4	9	18	22	6	3.29	0.54947

8	*The software used in our mathematics lessons is too complicated.*	0	1	13	24	21	4.10	0.00523
9	*I could not understand mathematical materials when software was applied.*	0	1	10	28	20	4.14	0.01128
10	*Using of technology in mathematics lessons makes mathematics more complicated.*	1	1	10	30	17	4.03	2E-05
11	*If the teacher does not use technological devices, I will understand mathematics lessons better.*	0	2	14	35	8	3.83	0.03956
12	Smartboard is more efficient than blackboard.	8	29	13	7	2	3.58	0.20533
13	Mathematics applications for iPad and smartphones are very useful.	15	29	12	3	0	3.95	0.00644
14	I like lessons with Zambak Interactive Form.	21	30	8	0	0	4.22	0.03646
15	I understand mathematics lessons better when teacher uses Zambak Interactive Form.	23	25	10	1	0	4.19	0.02466

General mean of the questionnaire is 4.03 and standard deviation is 0.28. Six of the items have a negative meaning and to find the mean of these items the scale was inverted (These items shown as bold italicized; their opposite mean is given in the table). This questionnaire shows that high school students support the usage of the software that the teacher chose for them ('appropriate software') in mathematics lessons. When the teachers use

appropriate software, students understand the topics better and when they understand better they like the subject more. Also, students like technology integration in the classrooms and they believe in the advantages of using the Smartboard. Zambak Interactive Form offers multidimensional teaching methods and strategies, because of this, students understand better. Its varied activities make the lessons more attractive and so students like this software. Figure one helps to see how the obtained means compare to each other.

Figure 1: Means of Items in Questionnaire 1



Overall, the results are good – the means are all above three, many above four. The highest mean (4.34) belongs to item 1: *"Using appropriate software make mathematics enjoyable."* The majority of the students (83%) believe that the use of appropriate software make the mathematics lessons attractive. Also, by using effective software we can make abstract mathematics lessons more enjoyable for students and so they will like our lessons.

Item 7 has the lowest mean (3.29). It is "*The exams including technological devices are harder than classical exams."* Actually, it was a negative item and its mean was converted to positive, but the result did not changed so much. 46% of the students agreed on this item and 36% are neutral. That shows, the exams are always horrible for students. Making exams by using some software cannot change for some students is an extra negative factor. On the other hand, technology-based exams are easy to check and more reliable than classic exams, so they are still preferable compared to on-paper exams. However, students need enough experience of applying technology-based tasks in order to remove the stress dealing with technology application at exams.

Item 12 has the second least average (3.58). This item is "*Smartboard is more efficient than blackboard*". Many teachers use Smartboard like a normal whiteboard, without using its rich potential. Probably due to this or just to the habit of using traditional boards, some students could not see any difference between a smartboard and a normal board. In the course of the experiment the researcher and the teacher tried to change this idea of the students.

In general, the mean of the items are high enough. Participants had positive perceptions of the used software and technological devices. They believe the benefits and attractiveness of them make students more successful in mathematics lessons.

For the second questionnaire:

There were 10 questions. 6 of the questions were check box and other 4 questions were open-ended questions. After the questionnaire was developed, it was sent to colleagues working in the same school network all over the world by different methods; e-mail, twitter, Facebook and printed papers. There were 58 responses from 9 countries. Table 3 below shows the countries and gender of respondents.

Table 3: Respondents of the teachers' questionnaire

COUNTRY	MEN	WOMEN	TOTAL
Kazakhstan	14	8	22
Georgia	13	4	17
Turkey	11	1	12
Iraq	2	0	2
Kosovo	1	0	1
Kyrgyzstan	1	0	1
Tajikistan	1	0	1
Australia	1	0	1
Indonesia	1	0	1
TOTAL	45	13	58

The majority (97%) of the respondents work in private schools. Their teaching experiences vary from 3 years to 24 years. The average of the teaching experience is 10.8 years. The majority of the respondents are from Kazakhstan and Georgia. 77% of the respondents are men but it is a normal distributions of the genders because in many countries the majority of teachers of technical sciences and mathematics are men, women prefer to teach humanities and social sciences.

Now, let us look at the questions and responses for these questions:

1. ***Do you expect from your administrators and head of mathematics department to promote technology integration in your classroom?***

Many teachers said that they need more support. They need better devices for their classrooms. As I understand, many the teachers have integrated technology but some of them are less qualified in using it. So, they want from their administrators to buy better devices. Also, they want to take courses and seminars to learn how to use the technological devices. Lack of suitable software is one of the most important matters. Many teachers think that it

is the duty of the head of mathematics department to find the best software for their lessons. In reality, the head cannot solve this problem alone but, he/she can manage the teachers to look for or to prepare the most effective software for their lessons. They may be in charge of selecting course books and materials and teams of teachers only can solve all these problems.

2. *What is/are the most important property (ies) of an effective software for teaching algebra?*

There were many different responses to this questions. The most repeated responses were:

- Compatible with the smartboard
- The ones which Include visual aids and multimedia materials
- Easy to use; its user interface should be clear and useful.
- Include many examples; solved or unsolved, classical or multiple choice, …
- Satisfy all needs of teachers and students; videos, questions' numbers and types, prepared exams, pictures, etc.
- The ones which involve 3D illustrations of the topics
- The ones which include real-life applications of given topics

3. *Do you use some special software for your lessons? What is the reason for selecting that software?*

Many teachers use the software that we analyzed and compared in the previous section. It is useful software that helps teachers. Many teachers prefer using PowerPoint and ActivInspire or similar Smartboard programs. As mentioned above, these are useful programs to make good presentations but their greatest disadvantage is that the teacher needs to prepare every single page of these programs and it takes the teachers much time. Also, more than half of the respondents use Zambak Interactive Form in their lessons. The reason for selecting this software is being technically easy to use. Also, teachers use Zambak Interactive Form for its visual aids, videos and activities.

4. *Are you satisfied from Zambak Interactive Form? And, what do you expect more?*

A small percentage of the responders (20-25%) mentioned that they did not use this software for some reason. The majority of other users (63%) are satisfied with the properties and content of the software but they believed that it would be better if more activities, videos and questions were added to it. Many teachers requested the solutions of questions, too. Another request was about saving the teacher's writings. In the program, teachers can write solutions of the questions by using Smartboard, but they cannot save their writings in Zambak. Inserting the videos of solutions may solve this problem. Also, teachers may include and save their own activities and materials to the program. For this, they need to take a small course. Also, some teachers requested leveled questions.

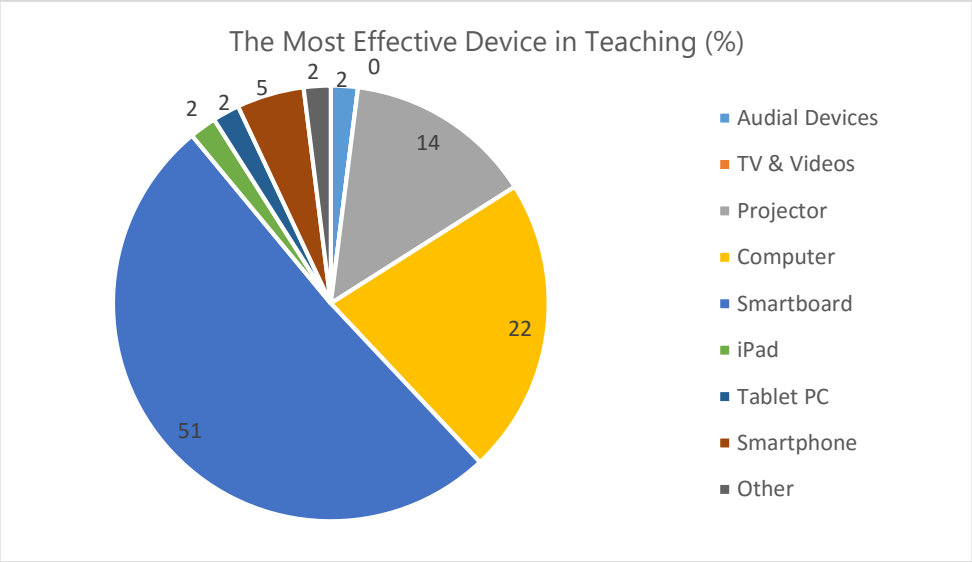
5. *What is the most efficient device in teaching?*

The majority of the respondents (51%) said that the most effective device is Smartboard. Computer is in the second place (22%) and in the third place is projector (14%). These three devices work together. Smartboard does not work without a computer and a projector. Also, projector need a computer or another device to show something.

Some of the respondents selected smartphone as the most effective device. It may be because of widespread usage of the smartphone. Because, almost every student, especially elder students, in today's schools have a smartphone. If we teachers them for educational purposes it will have many positive effects on the students. However, they are not very applicable for teaching mathematics.

Answers of the first question are listed in figure 2 below.

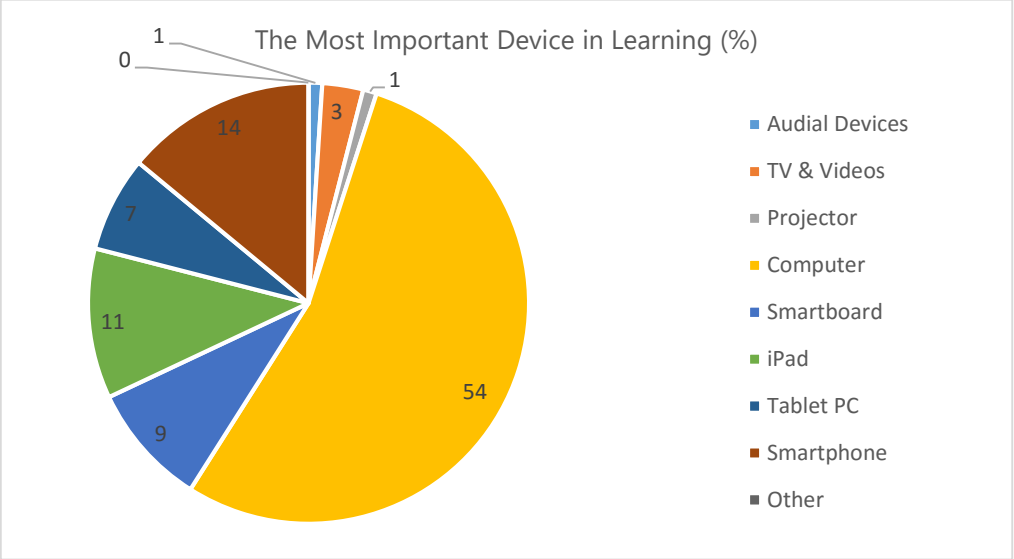
Figure 2: The most effective device in teaching



6. *What is the most important device in self-study?*

People may use different devices for teaching and learning. As we know, some devices may be used effectively for teaching (like Smartboard), but the same device may not be as useful for self-study. The answers of the respondents are listed in the figure 3 below.

Figure 3: The most important device for learning

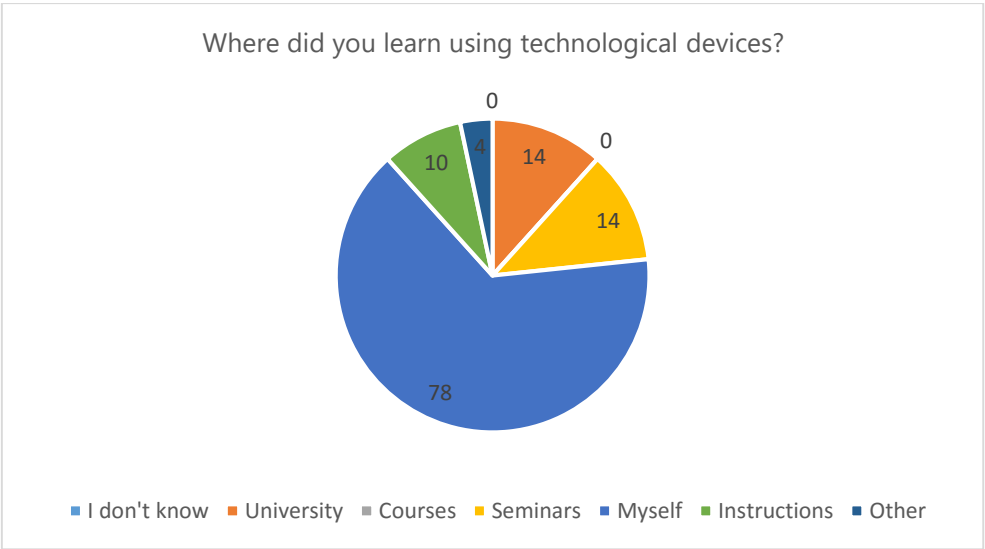


The most important equipment of self-study is the computer (54%). But developing technologies give students a chance to use different types of devices for learning. 14% of the respondents use smartphone as a learning tool. IPad is in the third place (11%). If iPad and Tablet PC will be added, together they will constitute 18% and take the second place.

7. *Where did you learn using educational technology devices?*

Many teachers found it easy to use any technological device. So, every teacher can use it without taking an extra course or seminar. The answers of this question are as follows:

Figure 4: Where did you learn using educational technology devices?



Teachers may give multiple answers to this question. 78% percent said that they learned it themselves. 14% learn from the university and 14% from the seminars. That shows that the use of educational technologies is not difficult. If a teacher has any type of technological device in his/her hand, with the help of the manual, by trying on it for a short time they can easily understand general properties of it. By using some instructions or watching some videos from the internet they can become experts of using these devices.

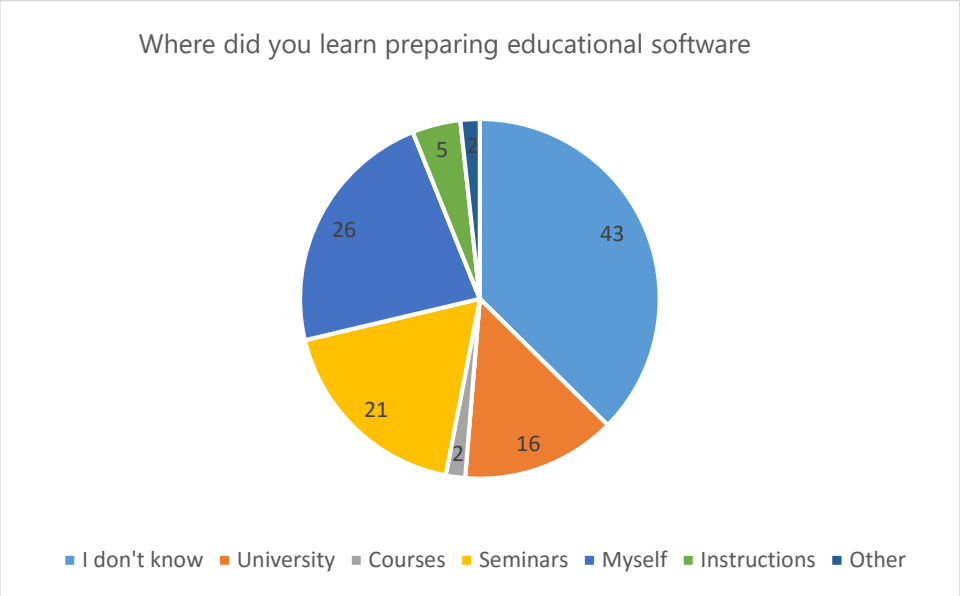
8. *Where/How did you learn developing educational software?*

It was mentioned above that educational software should be prepared by teachers and programmers in cooperation, or else teachers will need to learn programming and prepare the software. It is not so easy for all teachers, even of mathematics, to be a programmer but at least some teachers may learn developing educational software. If the universities hold some courses to teacher candidates in programming, it will help to increase the quality of the software. Also, companies may form teams including educators and programmers to prepare educational software.

The majority of the respondents (43%) cannot develop software. Other respondents give some answers to this question, such as some of them use some auxiliary programs to develop the contents of the educational software. The percentage of the teachers who know programming is only a few percent.

The responses to this question are as follows:

Figure 5: Where did you learn developing educational software?

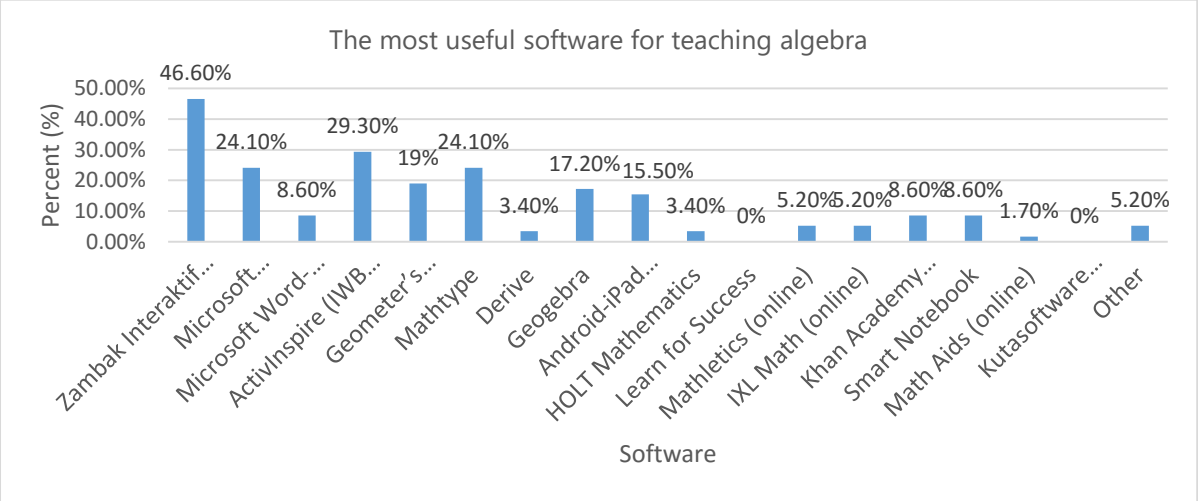


9. *What is most efficient/useful software for teaching algebra?*

Many of the responders know about Zambak Interactive Form. But there are some teachers that either have not seen this program or have not used it. The same thing can be said about other software. For this reason, we inserted

'other' option to this question. The responders were permitted to give maximum 3 answers to this question. The data are presented in figure 6.

Figure 6: The most useful software for teaching algebra



Zambak Interactive Form is in the first place (46.60%), ActivInspire is in the second order (29.30%). Microsoft PowerPoint and MathType have the same percentage (24.10%). Zambak Interactive Form includes many presentations and it uses the properties of ActivInspire but it has more properties and materials. Because of this, it is selected in the first place.

10. *What are the barriers to use the technological devices in the classroom?*

Teachers could choose three most important barriers. Many teachers are eager to use technological devices, but there are some important factors and barriers that prevent their use of technology. The answers of teachers are listed in table 4.

Table 4: Barriers of technology integration in education

BARRIER	PERCENTAGE
Lack of technological devices	57 %
Lack of appropriate educational software	39 %
Lack of knowledge of using devices	40 %
Lack of time for preparation	48 %
Lack of technical support	44 $
Lack of support from the administration	25 %
Curriculums of ministries of education	28 %
Number of students in the class	20 %
Teacher's motivation	3 %

As we see, the greatest problem (57%) is the lack of the technological devices or lack of better devices. So, we need to solve this problem firstly. School principals should pay more attention to technology integration in their classrooms.

Second important barrier (48%) is time pressure. Teachers need to give their time to prepare some materials to use in technological devices. If we can find some software that include all types of technological materials and software, teachers will solve their second greatest barrier.

If we solve these two problems, the rest of the barriers will not be significant problems because, better devices can solve 'technical support' barrier and preparing suitable software will solve 'lack of suitable software' and 'lack of time for preparation' barriers that are the greatest barriers for the technology integration in education.

That means, we need well qualified devices and suitable software. By this way, we can eliminate majority of the barriers of technology integration.

Conclusion

By looking at the first questionnaire we can conclude that the use of appropriate software in teaching mathematics has a great many benefits. It increases the achievement of students and students' motivation, improves the attitudes of students towards mathematics lessons. Students enjoy the lessons when teachers use effective software.

Effective software can offer different teaching methods for teachers and different learning methods for students. By this, it can satisfy the needs of different types of learners. It can convert boring lessons into enjoyable lesson and attract more students' attention. When students like a lesson, they study more and acquire more. So, it helps to increase the achievement.

Teachers can bring authentic materials into classroom environment and so they can attract students' attention and increase their motivation. By using the software, teachers can save the time in the lesson. Instead of writing everything by hand, they use written materials from the software and use the saved time in different activities and communicating with students.

The average of the first questionnaire was 4.03 in a 5-point Likert scale, which is good enough. It shows that students support use of appropriate software in teaching mathematics. So, when teachers use suitable software, the lessons will be more attractive and achievement of students will increase.

It was concluded from the second questionnaire that the use of technological devices is not so difficult. However, developing educational software is not so easy for many teachers. The majority of the teachers agreed on the positive impact of use of effective software in teaching. Administrators need to support their teachers to find or develop better software for their lessons. They may form teams of teachers to prepare educational materials and software. But before that they need to buy the most suitable for those purposes technological devices. As the questionnaire showed, the most useful device in teaching is the combination of computer, projector and smartboard. Other devices like smartphone or tablet PC can be also used actively in teaching.

It is possible to conclude that an effective device must have some properties like visual effects, multimedia support, different types of activities and question types, smartboard support, easy to use, user friendly, support authentic materials and so on. Zambak Interactive Form has all these properties and because of this, the majority of the students and teachers in the questionnaire showed it as the most effective software. Different programmers and teachers may prepare software similar to this one. For this, they need administrators' support.

To conclude, the greatest responsibility in technology integration belongs to teachers. So, it is necessary to motivate the teachers to integrate technological devices into their lessons. The use of appropriate software according to the above-mentioned criteria can increase the motivation of teachers in this integration. When teachers believe in the usefulness of technologies, they can overcome all types of barriers and give more qualified lessons to their students. Also, educational faculties have a great responsibility to teach the application and the development of educational software. These lessons may be some elective lessons but at least some of the teachers need to be able to develop the software in their subjects.

Further researches may generalize the results obtained in these studies for other subjects. Also, it will be beneficial if we search the methods for educating the teachers because the most important thing is to integrate the technology made by teachers or in cooperation with teachers. Thus, they need to find the software, they must develop the software and other needed materials. Seminars and courses for training the teachers have a crucial importance. Of course, much depends on the contents of these seminars. If teachers waste their time at those courses, it will be too difficult to persuade them take others.

Technology is changing rapidly. So, teachers and administrators need to be open for new technologies and their integration in the education. Also, they need to know the criteria for selecting the most useful device and most efficient software for their lessons.

References

Akpınar, Y. (2005). *Bilgisayar Destekli Eğitimde Uygulamalar*. Ankara: Anı Yayıncılık.

Andrews, K. (2008). *Human-Computer Interaction. Lecture Notes*. Graz: Graz University of Technology.

Aşkar, P. & Köksal, M. (1987). Bilgisayar destekli öğretimde kullanılan yazılım paketlerinin geliştirilmesinde ve değerlendirilmesinde dikkat edilecek noktalar: *Eğitim ve Bilim,*S-66.

Atiker, B. (2012*). İlköğretim Öğrencilerine Yönelik Bilgisayar Destekli Öğretim Yazılımları İçin Ekran Tasarımı İlkeleri.* (Master Thesis) Ankara: Gazi University.

Belyk, D. & Feist, D. (2002). Software Evaluation Criteria and Terminology. *The International Review of Research in Open and Distributed Learning 3(1).* Athabasca University. Retrieved March 5, 2016 from http://www.irrodl.org/index.php/irrodl/article/view/70/141

Bennett, F. (1996). Why Computers are Ineffective Today: *First Monday*. (1-6). Retrieved February 14, 2016 from: http://firstmonday.org/ojs/index.php/fm/article/view/502/423

Çelik, L. (2008). *Öğretim Teknolojileri ve Materyal Tasarımı*. Ankara: Pegem A Yayıncılık.

Çeliköz, N. & Erişen, Y. (2007). Eğitimde bilgisayar kullanımı. *Öğretim Teknolojileri ve Materyal Tasarımı* (111-144). Ankara: Pegem A Yayıncılık.

Dix, A., Finlay, J., Abowd, G. & Beale, R. (2004) *Human-Computer Interaction*. 3rd edition. Prentice-Hall International: USA.

Durak, G. (2009). *Algoritma Konusunda Geliştirilen "Programlama Mantığı Öğretici-P.M.Ö" Yazılımının Öğrenci Başarısına Etkisi.* (Master thesis). Balıkesir: Balıkesir Üniversitesi.

Ehrmann, S. C. (1999). Asking the hard questions about technology use and education: *The Magazine of Higher Learning* 31 (2), 24 – 29.

Feyzioğlu, B. (2006). *Farklı Öğrenme Süreçlerinin Temel Kimya Öğretilmesinde ve Kavram Yanılgılarının Giderilmesinde Kıyaslamalı Olarak Uygulanması.* Phd Dissertation. İzmir: Dokuz Eylül University.

Gillen, J., Staarman, J.K., Littleton, K., Mercer, N., & Twiner, A. (2006). *A* "Learning Revolution"? Investigating Pedagogic Practices around Interactive Whiteboards in British Primary Classrooms. AERA Conference 2006, San Francisco, Retrieved February 20, 2015, from http://www.educ.cam.ac.uk/research/projects/iwb/AERA2006.pdf

Güzeller, C. & Korkmaz, Ö. (2007). *Bilgisayar Destekli Öğretimde Bir Ders Yazılımı Değerlendirmesi.* Kastamonu Eğitim Dergisi, 15(1), 155-168.

Irvine, B. S. (2003). *Integrating Technology into Special Education.* Boston, MA: Houghton-Mifflin.

Jackson, G. B. (2000). How to Evaluate Educational Software and Websites. TechKnowLogia May/June. Knowledge Enterprise, Inc. Retrieved December 18, 2015 from: http://www.techknowlogia.org/tkl_articles/pdf/129.pdf

Kwiatkowska, A., Ziolko, E., & Krysta, K. (2007). Internet Addiction and Its Social Consequences. *European Neuro-Psychopharmacology*, 17(4), 559-560.

Leavitt, M. (2006). Learning From Visuals-How Visuals Can Help Students Learn. *White Paper.* Arizona State University. Retrieved March 5, 2016 from http://ca.wiley.com/legacy/college/visualizing/doc/whitepaper.pdf

Lin, S. S. J. & Tsai, C. C. (2002). Sensation seeking and Internet dependence of Taiwanese high school adolescents. *Computers in Human Behavior*, 18(4), 411–426.

MEB (2005). *Ortaöğretim Matematik (9-12. Sınıflar) Dersi Öğretim Programı.* Ankara: Milli Eğitim Bakanlığı Talim Terbiye Kurulu Başkanlığı.

Milton, J. (2002), *Literature Review in Languages, Technology and Learning*. Bristol: Futurelab.

Nielsen, J. & Loranger, H. (2006). *Prioritizing Web Usability*. USA: New Riders.

Özkan, H. H. (2005). *Öğrenme Öğretme Modelleri Açısından Modüler Öğretim.* Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 6(2), 105-116.

Tanyeri, T. (2008). *Bilgisayar Destekli Öğretim ile İlgili Temel Kavramlar Öğeleri Kuramsal Temelleri ve Uygulama Yöntemleri.* A Güneş (Eds). Bilgisayar I-II. Ankara: Pegem A Yayıncılık.

Todd, R. W. (2005). Three Modes of CALL Communication. Reflections. *Kmutt Journal of Education,* January 2005, 7, 13-24.

U.S. Congress Office of Technology Assessment (1988). *Power On! New Tools for Teaching and Learning.* Washington, D. C.: U. S. Government Printing Office, (OTA-SET-379), 142-3.

Witfelt, C. & Hansen, L. (1999), Educational Multimedia in Compulsory School: From *Pedagogical Assessment to Product Assessment. PEDACTICE Deliverable 6.2,* Edinburgh: Centre for Educational Sociology, University of Edinburgh.

Yalın, H. İ. (2003). *Öğretim Teknolojileri ve Materyal Geliştirme*. Nobel Yayın Dağıtım: Ankara.