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Procedia Social and Behavioral Sciences 2 (2010) 5357–5361

Procedia
Social and Behavioral Sciences

WCES-2010

The effect of using animations on pre-service science teachers' science achievement

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Received November 11, 2009; revised December 1, 2009; accepted January 22, 2010

Abstract

In this study, the effect of animation technique on the learning of properties of electromagnetic waves (EMWs) for pre-service science teachers has been investigated. The research has been carried out for two weeks on 2nd grade pre-service science teachers. This study has been carried out with experimental and control groups consisted of 70 students in total. 35 students were randomly assigned to experimental group and control group respectively. The achievement test was given to both groups before and after the treatment. Significant difference has been found between the experimental group and control group ($p<0,05$).

Keywords: Computer assisted instruction; science teaching; animation; electromagnetic waves; physics education.

1. Introduction

Technology can be seen as a remedy for students' science learning. Technology can make education more productive and make knowledge reachable for everybody (Linn, 2003). Technology can help students learn nature of scientific models according to White (2003). Scientific models constructed by using animations should help students explain real world situations. According to Schecker (2003), these technological tools can help students measure some quantities and construct models in their mind. Maybe, the most positive effect of technology use is causing students to be more autonomous learners.

Animations used in educational environment are one of the most powerful tools because they reduce the negative attitude of students toward learning. Students should be more willingness to learning. In addition, students' perception and attention skills can be improved with animations. Knowledge learned in enriched courses with animations is more permanent than traditional courses because animations address many senses of students such as seeing, hearing and reading (Daşdemir, 2006).

According to Najjar (1996), animations help students get positive attitude toward lessons, provide them three dimensionality thinking skills, and help them compete in contemporary education arenas. Using animations effectively in lessons provide students to acquire knowledge quickly, and help students focus on key concepts.

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doi:10.1016/j.sbspro.2010.03.873

Moreover, researchers have tried to support the effectiveness of using animations in teaching science, psychology and education for many years in their research. The purpose of their studies is to investigate how to and when to use technology effectively in science education. Recent studies show that using animations in lessons are more effective than traditional methods (Milheim 1993, Dalton 2003).

1.1. Problem statement

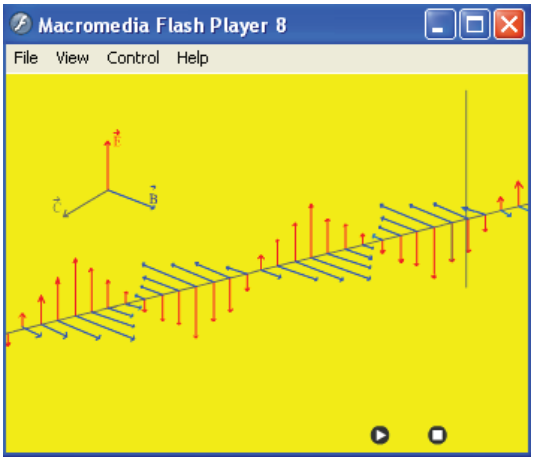
Misunderstanding of electromagnetic waves (EMWs) and properties of EMWs by pre-service teachers, and learning difficulty of EMWs due to its abstractness are serious problems. Especially, physics lecturers in universities don't give enough importance to choose appropriate teaching techniques. Subjects of modern physics courses consist of many abstract concepts and students have difficulties to understand them. Students can't give correct meanings to these abstract concepts when teachers use traditional methods. Students try to memorize facts and principles because they can not visualize physical events in their minds. If we want to teach subjects meaningfully, we should use methods activating students mentally.

1.2. Purpose

The purpose of this study is to investigate the effect of animation technique on the learning of properties of electromagnetic waves for the pre-service science teachers and to prepare effective instructional tools.

2. Method

Science education 2nd grade students (N=70) at the university of İnönü were randomly assigned to experimental (N=35) and control (N=35) groups to test the effectiveness of animation technique on students' achievement. Electromagnetic Achievement Test (EMAT) prepared by researchers was given to students to test the difference between achievement scores of students in experimental and control group as a pre and post test. Questions in the EMAT was prepared by considering whether students learn some objectives such as "reasons of how radio waves are produced", "what is the relationship between velocity, frequency, wave length, and energy of EMW", "position of electric field and magnetic field vectors toward each other in the wave model" and "properties of electromagnetic waves". Content validity of test is supported with preparing table of test specification and taking expert opinion about congruence between objectives and test items. In the period of two weeks, electromagnetic wave concept and properties of electromagnetic waves were taught to students with animation technique during six hours. Animations prepared with the help of Macromedia Flash 8 program were used to teach subjects to experimental group. 6 animations were used in which 5 are prepared by researchers and 1 is downloaded from internet. Used animations are showed in below figures.



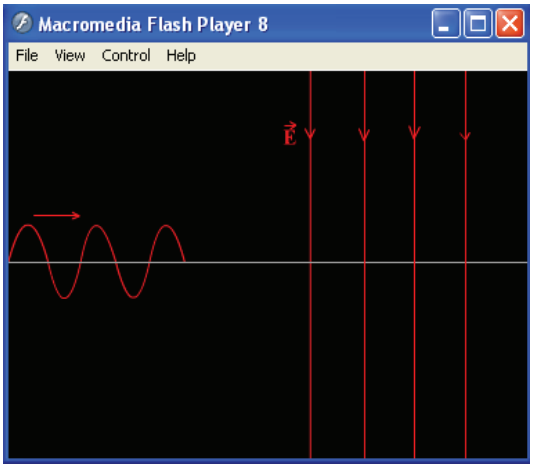


Figure 1. Vector representation of EMW.

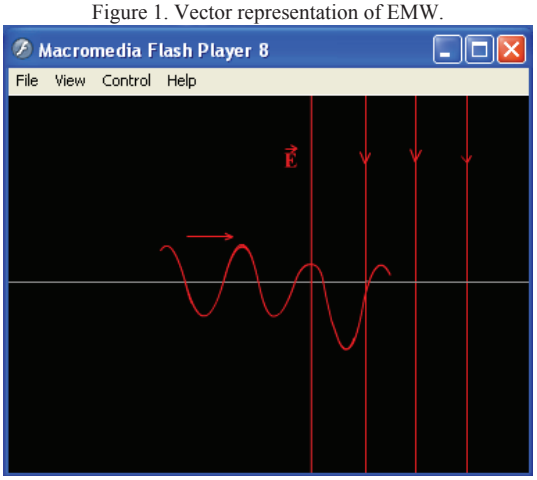


Figure 2. Path of EMW in vacuum.

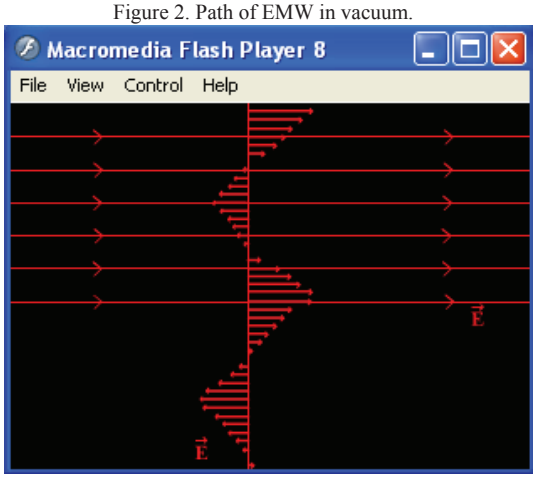


Figure 3. Path of EMW in electric field.

Figure 4. Representation of electric field vectors of EMW in electric field.

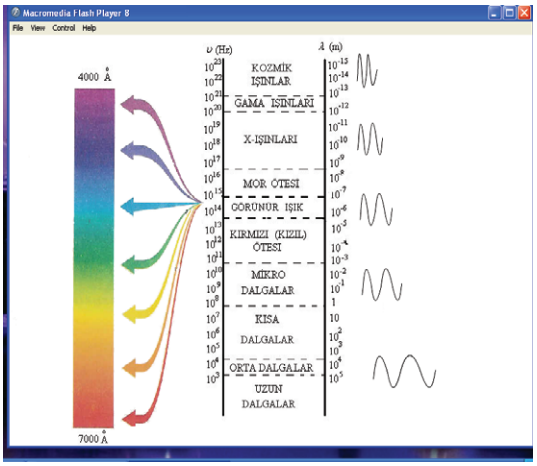


Figure 5. Spectrum of EMW.

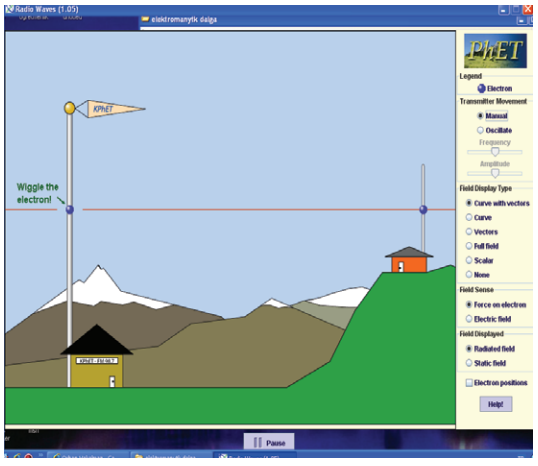


Figure 6. Formation of Radio Waves.

Animations used in this study correspond to some objectives. For example, animation in figure 1 was used to show students position of electric field and magnetic field vectors toward each other in the wave model, phases of electric field and magnetic field vectors in wave model and how EMW oscillates. Second, figure 2 and figure 3 was used to show students how EMW behaves in electric filed. Figure 4 was used to show students how magnitude of electric field vectors of EMW changes in electric filed and to show students that there is no change in the direction of electric field vectors of EMW in electric field. Figure 5 was used to show relationship between velocity, frequency, wave length, and energy of EMW. Finally, figure 6 was used to show formation of radio waves.

3. Results (Findings)

Independent t test was used to compare the mean scores of students in two groups experimental and control. As shown in the below tables; we couldn't find enough evidence to conclude that there is a significant difference in mean pretest scores of students in two groups and we couldn't find enough evidence to conclude that there is no significant difference in mean posttest scores of students in two groups. Therefore, we don't have evidence to conclude that animations are not more effective in increasing students' success in the subject of EMW.

Table 1. Mean scores of students in pretest

	GROUP	N	Mean	Std. Deviation	Std. Error Mean
pretest	control	35	22,2857	17,33506	2,93016
	experiment	35	18,2857	19,62677	3,31753

Table 2. Independent sample t test for pretest

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
pretest	Equal variances assumed	,718	,400	,904	68	,369	4,0000	4,42627	-4,83248	12,83248
	Equal variances not assumed			,904	66,978	,369	4,0000	4,42627	-4,83492	12,83492

$\mathbf{H_0}$: $\mu = \mu_2$
$\mathbf{H_a}$: $\mu_1 \neq \mu_2$
$p=0.369 > \alpha=0.050$ (fail to reject H_0)

Table 3. Mean scores of students in posttest

	GROUP	N	Mean	Std. Deviation	Std. Error Mean
postest	control	35	40,5714	24,96384	4,21966
	experiment	35	65,1429	24,41931	4,12762

Table 4. Independent sample t test for posttest

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Posttest	Equal variances assumed	,037	,847	-4,163	68	,000	-24,5714	5,90277	-36,35023	-12,79263
	Equal variances not assumed			-4,163	67,967	,000	-24,5714	5,90277	-36,35033	-12,79252

$\mathbf{H_0}$: $\mu_1 = \mu_2$
$\mathbf{H_a}$: $\mu_1 \neq \mu_2$
$p=0.001 < \alpha=0.050$ (reject H_0)

4. Discussion

Used technological materials in education increase the motivations of students, attitude of students toward lessons and achievement of students. These materials make lessons more attractive and effective (Kıyıcı & Yumuşak, 2005). Teacher candidates usually imitate their teachers' behaviors so they follow same steps while they are teaching something in their professional life. Imitating their teachers can cause some problems for teacher candidates in teaching science to future generations. Although university lecturers support the importance of using technological tools in educational environment, they can not be model for their students with their behaviors. Maybe the reason for this, university lectures think their students as an autonomous learners and responsible persons for their learning. However, thinking like this is a wrong idea as our study shows. We think that detailed curriculums integrated with several visual activities should be prepared for university students.

5. Conclusion and Recommendation

In this era, computers have a big role in communication and transfer of knowledge in today's world. Computers facilitate learning and help learners reach knowledge easy. Many people know how to use computers and how to connect internet nowadays. Students watch animations, videos and films with the help of computers in their home. Therefore, schools are not only place where the knowledge is transmitted or constructed anymore. Students want to reach knowledge quickly and see interesting things while they are learning. For example, well prepared and interesting animations can make concepts more concrete, meaningful and permanent in students' minds.

This study shows us that university lecturers should be more careful while choosing appropriate instructional tools. They should use several instructional techniques in which students are more mentally active. Instead of giving importance to using mathematical calculations in lessons, they should consider to improve students' intellectual abilities. In addition, students' motivation toward lesson should be increased by the help of animations and students should be more willingness to engage in lessons.

We think that using animations to teach abstract concepts like EMW is one of most powerful technological tools as literature says because there is a huge difference in mean scores of students between experimental and control groups. Therefore, animation technique should be chosen to teach abstract concepts in universities because preparing animations is not very difficult process. New departments dealing only with educational technology in universities should be opened to develop technologic educational tools.

References

Dalton, R., M. (2003). The Development of Students' Mental Models of Chemical Substances and Processes at the Molecular Level, Unpublished PhD Thesis, University of Western Sydney, Australia.

Daşdemir, İ. (2006). The Effect of Using Animation on Students' Academic Achievement and Retentions in Primary Science schools. University of Atatürk. Unpublished Master Thesis.

Kıyıcı, G & Yumuşak, A. (2005). The effects of computer assisted activity at science laboratory lesson on student's acquire; example of acid-base concepts and titration topic. The Turkish Online Journal of Educational Technology, Vol: 4, Issue 4, Article:16.

Linn, M., C. (2003). The Impact of Technology on Science Instruction: Historical Trends and Current Opportunities. International Handbook of Science Education. Vol:1, (pp.265-294), Dordrecht: Kluwer Academic Publishing.

Milheim, W., D. (1993). How to Use Animation in Computer Assisted Learning. British Journal of Educational Technology. 24, 171-178.

Najjar, L., C. (1996). Multimedia Information and Learning. Journal of Education Multimedia and Hypermedia. 5, 129-150.

Schecker, H., P. (2003). Integration of Experimenting and Modeling by Advanced Educational Technology: Examples from Nuclear Physics. International Handbook of Science Education. Vol:1 (pp.383-398), Dordrecht: Kluwer Academic Publishing.

White, B., Y. (2003). Computer Microworlds and Scientific Inquiry: An Alternative Approach to Science Education. International Handbook of Science Education. Vol:1, (pp.295-315), Dordrecht: Kluwer Academic Publishing.