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USING SLOWMATION AS A TEACHING APPROACH AND ITS EFFECT ON BIOLOGY ACHIEVEMENTS OF PRE-SERVICE SCIENCE TEACHERS

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ABSTRACT: Digital technologies offer increasing opportunities for students in primary or secondary schools to create their own digital media. "Slowmation" (abbreviated from "Slow Motion Animation") is a simplified way of making an animation so that students, themselves, can create it as a new way of learning about some science concepts.
In this study, pre- and post-test quasi-experimental design with control group was used with retention test. During the study, for the experimental group of students, additionally to biology instruction, slowmation has been used as a teaching approach. The implementation lasted 9 weeks. The data gathered by an 18 question-multiple choice test. It was developed by researcher and used as pre-, post- and retention test in order to measure students' biology course achievement. As a result of the research, it was determined that using slowmations as teaching approach for biology instruction increased the students' biology course achievement more significantly for post- and retention implementations.

Key words: Slowmation, science teacher, pre-service teacher

INTRODUCTION

Using technology that is readily accessible can sometimes be a catalyst for such engagement, especially if the tools help pre-service teachers to represent their knowledge in innovative ways (Kim & Reeves, 2007; Lee, Linn, Varma, & Liu, 2010). With the rapid advancement in personal digital technologies, it is becoming easier for students such as pre-service teachers to design media products such as animations and videos, which may be a way to support their conceptual understanding of science concepts that are typical in the primary school curriculum (Hoban & Nielsen, 2012). In several studies involving animations made by experts to assist students in learning science concepts have produced mixed results. Some studies have shown that watching animations to explain science concepts has improved the knowledge of high school and college students (Marbach-Ad, Rotbain, & Stavy, 2008; Williamson & Abraham, 1995). But in some studies, contrarily, it has been found that there has been little improvement in learning when students watch animations explaining science concepts (Sanger & Greenbowe, 2000; Yang, Andre, Greenbowe, & Tibell, 2003). According to Chan and Black (2005), animations could provide a motivation for engaging with content if learners become the designers and creators rather than consumers of information as in expert generated animations. Although this possibility of motivation for engaging with the content, designing and creating students' own animations have been limited because, this process requires time and sophisticated software and the process is too complex (Hoban & Nielsen, 2012).

Slowmation

Slow Motion Animation (abbreviated to "Slowmation") is a new teaching approach that has been developed over the last decade in science education classes at the University of Wollongong. This approach simplifies the

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complex process of making animations to enable learners to create their own comprehensive animations about science concepts (Hoban, 2005, 2007, 2009; Hoban & Ferry, 2006). Slowmation technic is similar to clay animation and in this approach, students make research, storyboard, design models, capture digital still images of small manual movements of the models. After these, they use a computer software to play the images in a sequence to simulate movement.

Making a movie using a traditional stop-motion animation technique is feasible, because the creator who manually moves the objects while taking each digital still photograph, thus eliminates the need for complex mechanisms to provide movement. Having pre-service teachers take digital still photos one by one, instead of a continuous 25–30 frames per second as in video, also allows them to check, manipulate, think about, discuss and reconfigure the models with each movement and photograph (Hoban & Nielsen, 2011).

Pre-service teachers can learn the process at the beginning of a course period and can prepare their models made out of daily routine materials such as plasticine, paper, and existing plastic models. If the materials are ready and available, in the course period, they can continue and take digital photos as the models are moved manually. The creation process integrates features of clay animation, object animation and digital storytelling and involves the pre-service teachers in designing and a sequence of representations (Hoban and Nielsen, 2010); (a) research notes, (b) storyboard, (c) models, (d) digital photographs and (e) narrated animation.

In summary, slowmation greatly simplifies the process of creating a stop-motion animation by enabling pre-service teachers to (i) make or use existing 2-D or 3-D models that may lie flat on a table or the floor; (ii) play the animation slowly at 2 frames per second requiring 10 times fewer photos than required in normal animation and (iii) use widely available technology such as a digital still camera, a tripod and free movie-making computer software (Hoban & Nielsen, 2012). McKnight, Hoban and Nielsen (2011), have explained that a slowmation displays the following features:

• *Purpose* - the goal of a slowmation is for pre-service teachers to make use of 1-2 minute animated mini-movie to tell a story, and through the creation process, learn about the story's meaning. The design of the slowmation can include a range of technological enhancements such as narration, music, other photos, diagrams, models, labels, questions, static images, repetitions and characters.

• *Timing* - slowmations are usually played slowly at 2 frames/second, not the usual animation speed of 20-24 frames/second, and thus need ten times fewer photos than in clay or computer animation, hence the name "Slow Animation" or "Slowmation";

• *Orientation* - models are made in 3D and/or 2D and usually manipulated in the horizontal plane (on the floor or on a table) and photographed by a digital still camera mounted on a tripod looking down or across at the model. This makes the models easier to make, move and photograph;

• *Materials* - because models do not have to stand up, many different materials can be used such as soft play dough, plasticine, 2D pictures, drawings, written text, existing 3D models, felt, cardboard cut-outs and natural materials such as leaves, rocks or fruit; and,

• *Technology* – pre-service teachers use their own digital still cameras (with photo quality set on low resolution so as to avoid overloading the editing software) or cameras in mobile phones and free movie-making software available on their computers (e.g. *iMovie* or *SAM Animation* on a Mac or *Windows Movie Maker* on a PC)

Purpose of the Study

The purpose of this study is to determine whether the approach is effective on students' success in some biology content or not. For this aim, following research question has been examined to conduct this study.

How does the slowmation approach influence pre-service teachers' biology achievement?

METHODS

Research Design

This study used a quasi-experimental (two-group pretest–posttest) design to compare the effects of slowmation as teaching and learning approach in biology achievement of pre-service science teachers.

Participants

This study was conducted in fall semester of 2013 and used quasi-experimental (pre- and post-test control group design) study design to examine the effects of slowmation in learning biology and students biology achievement. No specific exclusion criteria were identified. Experimental and control group participants were identified on the base of volunteerism. After a short information was given about the slowmation application in computer course, students were asked to select one of the two classes.
The pre-service teachers were enrolled in one semester Computer course in the second year of a four year Education Faculty. The students were also enrolled in General Biology course in the same semester. In this study, the forty nine pre-service science teachers were invited to be in the research project for making slowmations as experimental group and 45 of them volunteered. On the other hand, the control group was for 38 pre-service science teachers. The pre-service teachers in experimental group received a workshop to explain how they could create a slowmation. Pre-service science teachers were allocated typical biology topics (e.g., mitosis, meiosis, reproduction) which were selected from general biology course content after the workshop. They were expected to create a 2–4 minutes narrated slowmation as one assessment task to explain a science concept from their allocated topic.

Instrument and Data Collection

Data of this research gathered by biology achievement test. The test was multiple choice for 18 items. The biology achievement test for 25 items was applied as a pilot study to the students (n=63) who completed the basic biology course at the end of the previous semester (spring semester of 2012) and after the item analysis, 7 items were excluded from the test. This multiple choice biology achievement test was applied as pre- and post-test. The biology achievement test was used again to examine the permanency two months later.

Table 1. The Data Collection and Application Process of the Study

Groups	Pre-Test	Slowmation Creation	Post-Test	Retention Test
Control (n=38)	X	⟶	X	X
Experimental (n=45)	X	X	X	X

Data Analysis

The data gathered from pre-service science teachers were analyzed using the SPSS Software (v.16.0). Descriptive statistics were calculated to summarize the sample characteristics and the subjects' answers. To assess mean differences between pre- and post- and retention test biology achievement scores for each groups, paired sample t-Test was used. To compare the mean difference of experimental and control group, (binary comparisons of pre- and post- and retention-test), independent samples t-test were used. For all analyses, $p < .05$ was considered statistically significant.

RESULTS and FINDINGS

The means and standart deviations of biology achievement scores of two groups (experimental and control) for pre- and post- and retention-test measurements were given in Table 2.

Table 2. Descriptive statistics of biology achievement for two treatment groups

Group	Pre-Test Mean (SD)	Post-Test Mean (SD)	Retention Test Mean (SD)
Control	6,82 (3,83)	7,47 (3,51)	6,97 (2,75)
Experimental	5,73 (2,85)	9,56 (3,00)	7,76 (2,68)

As can be seen from Table 2, the mean scores of biology achievement test increased from pre to posttest measurement for both group and decreased from post to retention test. According to Table 2, for the control

group, only a small amount of the mean score changes occurred among the pre-, post- and retention test measurements.

Paired samples t-Test was carried out on to determine the difference in the pre- and post- and retention-test measurements of biology achievement for each groups (control and experimental). In other words, t-Test was performed to investigate the effect of slowmation approach on the biology achievement of the pre-service science teachers. The results are shown in the following table (See; Table 3 and Table 4).

As seen in the Table 3, there was a significant difference in the scores for pre-test (M=6.82, SD=3.83) and post-test (M=7.47, SD=3.51) conditions; t(37) = -2.749, p =0,009*. There were not significant differences in the scores for post-test (M=7.47, SD=3.51) and ret-test (M=6.97, SD=2.75) conditions; t(37) = 0.705, p=0,485 and for pre-test (M=6.82, SD=3.83) and ret-test (M=6.97, SD=2.75) conditions; t(37) = -0.197, p=0,845.

Table 3. Paired Samples t-Test Results for Control Group

For Control Group	n	X	SD	df	t	p
Pre-test	38	6,82	3,83	37	-2,749	.009
Post-test	38	7,47	3,51			
Post-test	38	7,47	3,51	37	,705	,485
Ret-test	38	6,97	2,75			
Pre-test	38	6,82	3,83	37	-,197	,845
Ret-test	38	6,97	2,75			

When same analysis were done for experimental group, as seen in the Table 4, there were significant differences in the scores for pre-test (M=5.73, SD=2.85) and post-test (M=9.56, SD=3.01) conditions; t(44) = -5.642, p =0,000* and for post-test (M=9.56, SD=3.01) and ret-test (M=7.76, SD=2.68) conditions; t(37) = 0.705, p=0,485 and for pre-test (M=6.82, SD=3.83) and ret-test (M=6.97, SD=2.75) conditions; t(37) = -0.197, p=0,845.

Table 3. Paired Samples t-Test Results for Experimental Group

For Experimental Group	n	X	SD	df	t	p
Pre-test	45	5,73	2,85	44	-5,642	,000
Post-test	45	9,56	3,01			
Post-test	45	9,56	3,01	44	3,203	,003
Ret-test	45	7,76	2,68			
Pre-test	45	5,73	2,85	44	-3,179	,003
Ret-test	45	7,76	2,68			

The mean scores for treatment groups in pre- and past- and retention-test measurement were summarized below (Figure 1).

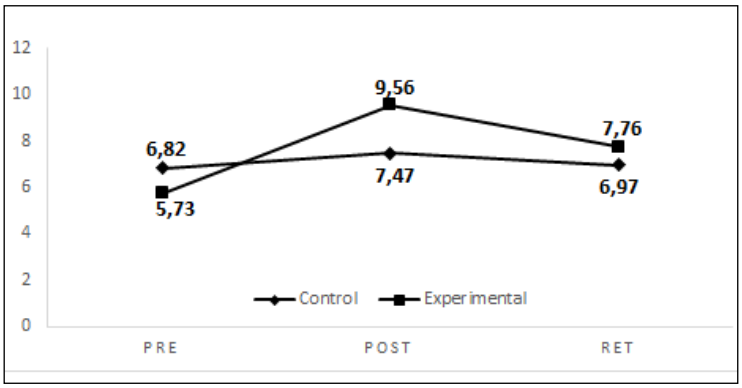

Figure 1. Mean Scores of Control and Experimental Groups in Pre- and Past- and Retention Test

Binary Comparisons of the Mean Scores of Control and Experimental Groups

Table 4 shows how to combine results from several t-tests performed for the same groups. According to Table 4, there are statistically significant differences, at the .05 level of significance, between control and experimental group students in biology achievement scores, but not pre- and retention-test. Results show that experimental group students had higher achievement scores, but no statistical difference exists between control and experimental groups in pre- and retention-test in terms of biology achievement scores.

Table 4. Results of t-test and Descriptive Statistics for pre- and post- and retention-test by groups

	Groups									
	Control			Experimental			95% CI for Mean			
	M	SD	n	M	SD	n	Difference	t	df	p
Pre-Test	6,82	3,826	38	5,73	2,85	45	-0.418, 2.54	1.439*	67,321	0,155
Post-Test	7,47	3,51	38	9,56	3,01	45	-3.50, -0.66	-2,913	81	0,005
Ret-Test	6,97	2,75	38	7,76	2,68	45	-1.97, 0.41	-1,309	81	0,194

* Second row values were used because equal variance not assumed ($p < .05$).

CONCLUSION

With the lack of empirical studies related to effect of slowmation creation process as a teaching and learning approach, this study introduced the results of quasi-experimental research design. According to the results of study, slowmation approach has positive influence on students' biology achievement. Besides, the contribution of slowmation approach to the achievement of students who creates them, when we think about the increasing in whole group mean scores, we should take into account the effect of presentation and discussion after presentation phases. As a result, "we should not teach them, they should learn themselves". Although there were no significant differences between the mean scores of pre- and retention-test and between the mean scores pre- and ret-test measurements, there were between the mean scores of pre- and post-test for control group and between all of the mean scores of experimental group.

RECOMMENDATIONS

Both experimental researches and use of this approach in teacher training and/or in middle and high school should be increased.

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