Preservice Science Teachers' Opinions Toward Motion Infographic and its Use in Teaching

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Abstract

The following study examines the opinions on Motion Infographics (MI) of 37 students-teacher for middle and secondary school science education. The participants spent four weeks creating their own MI after being taught and trained about MI, after which they were asked to fill in a questionnaire designed to seek their opinions and experiences. The study revealed that students-teacher generally have a favorable opinion about using MI as an instructional media in learning and teaching scenarios; however, they also claim that due to students' various learning styles and content being covered in the curricula, not all topics can benefit from the use of MI. The participants also expressed some difficulties in the creation process, citing lack of prior knowledge, and lack of training. Some recommendations include more exposure to infographics and further training for the production and use of MI for the students-teacher.

Keywords: Students-teacher, Science teacher, Infographic, Motion Infographic, Middle school, High school.

آراء الطلبة المعلمين نحو استخدام الانفوجرافيك المتحرك (Motion Infographic) في التعليم

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الملخص

هدفت هذه الدراسة إلى التعرف على آراء الطلبة المعلمين حول الانفوجرافيك المتحرك وتكونت عينة الدراسة من (37) طالبة في كلية التربية بتخصص العلوم للمرحلة المتوسطة والثانوية في جامعة الكويت. استمرت الدراسة لمدة أربعة أسابيع قامت أفراد العينة بإنتاج الانفوجرافيك المتحرك باستخدام برنامج بوربوينت Microsoft PowerPoint. وكشفت الدراسة أن معظم الطالبات لديهن رأي إيجابي حول استخدام الانفوجرافيك المتحرك للتعليم والتعلم، كما أعربت أفراد العينة أنه نظرا لأساليب التعلم المختلفة للطلبة وطبيعة المواضيع الذي يتم تغطيتها في المناهج الدراسية، فإنه لا يمكن استخدام الانفوجرافيك المتحرك لجميع المواضيع. كما ذكرت المشاركات عن وجود صعوبات في عملية انتاج الانفوجرافيك المتحرك لحداثة الموضوع لديهن وحاجتهن لتدريب أكثر. وأوصت الدراسة إلى حاجة الطلبة المعلمين إلى المزيد من التدريب على إنتاج واستخدام الانفوجرافيك المتحرك في التعليم.

الكلمات الافتتاحية: الطالب المعلم، معلم العلوم، انفوجرافيك، الانفوجرافيك المتحرك، المرحلة المتوسطة، المرحلة الثانوية.

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Introduction

Infographics have emerged due to the rapid nature of technological advancement. As defined by Toth (2013), infographics are a combination of text and visuals that deliver specific information quickly and easily to their subjects. In addition, infographics usually break down information that is normally quite difficult to comprehend (Lamb & Johnson, 2014), through the form of graphic representation of data. The evolution of information technology has required new approaches be introduced in educational settings, such as introducing new instructional media, as well as, for example, supplementing educational methods and techniques via infographics. Infographics are versatile in nature, allowing information to be depicted through visualizations of different

forms (Williams, 2002), also known as information design, data visualization, or information architecture. A vast amount of information may be depicted in an infographic that contains very little explanation (Lester, 2011), which can be alluring to several senses as it presents itself in a fascinating manner. (Abilock & Williams, 2014; Lamb & Johnson, 2014).

Al-Haddad (2018) revealed different types of infographics: “Static Infographics” include a print version, and three types of digital versions. Some of these types may involve animation as GIF format. The other type “Motion Infographics” or “Motion Infographic Videos”, abbreviated in this study as (MI), involves moving visuals and graphics. The motion of the content helps simplify complex information, allowing faster and easier understanding by the viewer. This type of infographics is characterized by features including sound effects. The information presented in MI flows in a logical sequence of events similar to storytelling.

Ru and Ming (2014) have discussed in their study the impact of infographic application in educational design. Their study has shown that infographics have enriched instructional design quality as it merged information and context. In accordance with Coleman’s (2010) study, there has been an increase in the usage of infographics by teachers in US elementary schools as a medium to clarify information to their students. Likewise, a study by Ozdamli, Kocakoyun, Sahin & Akdag (2016) introduced infographics to university-level anatomy students. These students had not been exposed to anything of this sort before. They claimed that information was easily recalled due to the use of infographics as data was simplified.

Several studies in Saudi Arabia introduced infographics as an educational tool. Al-Mohammadi (2017) investigated the

introduction of infographics in teaching methods to high school students in Makkah. The results of the study illustrated efficiency in further developing analytical thinking skills. Similarly, Najran (2016) explored traditional teaching methods and interactive infographics methods on two groups of second grade students. The results showed that those who were introduced to infographics scored higher than those taught with traditional methods. Al Ba'aly (2013) reached a similar conclusion with his first-grade students; it appeared that scientific and mathematical information was easily recalled when infographics were introduced.

Reinforcing the implication that infographics aid in the recollection of learning concepts within student perceptions, Shafie, Janier, and Wan-Ahmad (2009) studied the usefulness of visual representation within instruction. Their study concluded that students exposed to infographics as a mathematical educational tool interacted more efficiently. Complex topics within the scientific realm were more accessible when properly designed infographics were introduced, according to Hassan (2016) and Yildirim, Yıldırım, Çelik, and Aydın. (2014).

Infographics within an educational environment provide numerous advantages. Recalling data learned within different educational environments whether remote or local, displaying course content, and dispatching processes and events are just some of the benefits of infographics according to Meeusah and Tangkijviwat (2013). As a tool, they provide visuals for information that can be used in a storytelling sequence to further present data effectively to students (Uyan Dur, 2014). Using infographics eases student's perception and interaction during the lecture (Alqudah, Bidin, & Md Hussin, 2019).

Alhadad (2018) claimed that the MI helped sixth grade students retain and recall the information longer. Also, the students enjoyed the MI when used to teach them because the information was presented within a short time and the visuals exemplified the information very well. In another study (Dashti & Alhadad), students were found to enjoy the MI as an instructional media since it is a summary of the textbook and expressed their willingness to have a copy on YouTube site so that they can watch it anytime and anywhere.

Tsai, Huang, and Chang, (2020) used MI in a resource classroom at elementary school with mild disabilities students for teaching the climatic phenomenon that recently occurred in Taiwan. The students achieved better in the posttest. They claimed that MI can present the content in a simple, clear, and memorable way. MI can enhance the continuous presentation and fluency of the content. Also, the students were more precise when they drew the content. Baglama Yucesoy, Uzunboylu, and Özcan, (2017) recommended giving training sections to special education teachers in how to use visual technologies in form of infographics to enhance learning.

Tarkhova et al. (2020) highlighted (delete) the importance of technology competencies for the production of infographic to be used in digital presentation slides. Islamoglu et al. (2015) have recalled the need for pre-service teachers to be exposed and trained to understand infographics. Such courses would improve their ability to translate information more clearly to their own students. Therefore, it is recommended to train teachers on how to employ infographics in teaching and learning. (Shahin, 2020).

Afify, (2018) believed that using static or animated infographic in teaching students in colleges of education helps them develop skills in designing and producing visual learning

materials. This is because infographics (static or animated) based on visual attraction that presents the knowledge in form of visual symbols as images, shapes, arrows, (delete) can help learners realize important points in the subject matter quickly.

Fadzil (2018) found out in his study that when pre-service science teachers were exposed to the experience of producing infographics, the participants claimed that the experience was useful for them as per-service teachers, added a positive attitude about technology, and, as science teachers, they are willing to benefit from this experience in the future. At the same time, the participants mentioned some challenges that they faced in the production of the infographics. They claimed that the production of infographic is time consuming; they need to explore the infographic-maker to decide which suits them better, and master the skills needed. Since infographics creeped into our life and the infographic tools are available online, this will lead us to believe that infographic might become the main method of visual display (Damyanov & Tsankov, 2018).

It is worth mentioning that based on the researchers' exploration, research on the use of MI in educational settings has been quite limited as most studies have focused on static infographics.

Research Questions:

This paper seeks to answer the following questions:

1. What are students-teacher's opinions about using MI as an instructional media in teaching science to middle and secondary grade levels?

   The above general question generates the following sub-questions:

1.1. What are the students-teacher's opinions about producing educational MI for science topics to middle and secondary grade levels?
1.2. What are the students-teacher's opinions about the effect of educational MI on students learning science in middle and secondary grade levels?
1.3. What are the students-teacher's opinions about the effect of educational MI in teaching science for middle and secondary grade levels?
1.4. What are the students-teacher's opinions about using educational MI in teaching science to middle and secondary grade levels?

2. Are there any significant differences between students-teacher's opinions using MI as an instructional media in teaching science to middle and secondary grade levels if whether they have or have not completed the "Computer in Education" course (Comp. Edu)?
3. Are there any significant differences between students-teacher's opinions using MI as an instructional media in teaching science to middle and secondary grade levels regarding their GPA?

Methodology

The study consists of two parts, a pilot study and a main study

Pilot Study

A pilot study was conducted to evaluate the clarity and reliability of the questionnaire and the training. The participants were 20 female students-teachers registered in a "Basics for Teaching Science" course for middle and secondary schools as part of their degree at the College of Education, Kuwait University.

The participants were introduced to the MI, and samples of educational MI were presented to them as part of explaining what the MI means since it is a new topic for them. The differences between MI and regular videos or films were discussed with the participants. The strength and weakness of the samples were then discussed. Moreover, the rubrics for the MI were discussed with them. The criteria for the educational MI that were mentioned by Alhadad (2018) were adopted:

- logical sequence of information similar to storytelling
- use simple and high-quality visuals (pictures, drawings, symbols, diagrams, charts)
- choose the visuals and texts suitable for age and educational level of learners
- do not use information that it is not related to the topic and subject
- learners understand and grasp the information fast

Microsoft Office PowerPoint (PP) was chosen for the production of the MI. The justifications for using PP is that the pre-service science teachers are familiar with the program as they are trained to use it in the secondary school. They were also asked before the training if they used PP during college and how they utilized it. Both groups, within the pilot study and the main study, answered that they used PP for presentations in their classes at college. The second reason for choosing PP is that the computer labs that the participants will be trained on have the version of PP (PP 2016 or MS office 365 PP) which makes it possible to save the file as a video (mp4 format). Also, PP contains features like animation, using many types of images, as well as the ability to edit them, insert videos and sound, which helps in the production of MI.

The participants were trained on PP skills that will help them in the production of the MI. The training and production time took four weeks. They were asked to choose a topic from middle or secondary schools' curricula for producing a motion infographic. During the production, they were supervised by the researchers. After four weeks, they submitted the motion infographic and filled in the questionnaire.

Questionnaire

To answer the research questions, a questionnaire of 5 Likert-type scale was developed. The first part of the questionnaire gathered demographic information about pre-service science teachers, completion of the "computer education" course, and their GPA. The second part of the questionnaire has 50 statements regarding the MI. The questionnaire was divided into four categories. The first category has 16 statements regarding the production of MI. The second category has 9 statements about the effect of MI on student's learning. The third category has 11 statements about the effect of the MI on teaching science. Lastly, the fourth category has 14 statements about the use of MI in the future because when they graduate, they would become science teachers either in middle or secondary schools. All categories of the questionnaire end with an open-ended question that asks the participants to add any comments, if necessary, concerning any of the categories. The questionnaire was reviewed by colleagues majored in "educational technology" and others in "curriculum and teaching science". The questionnaire was given to the participants after they have submitted the MI and were asked to fill it out at their convenience and to submit it within a week. Based on comments and feedback received from the pre-service science teachers, a few amendments were done.

Main study

Participants

The sample in this study included 37 female students-teacher registered in the course "Basics for Teaching Science" for middle and secondary schools in a section that differs from that of the pilot study. Table 1 below presents students' distribution. The participants attended all the lectures for the MI training and production then filled in the questionnaire.

Table 1

Participants distributions

Category		Frequency	Percent
Finished (Comp. Edu) course	No	17	45.9
	Yes	20	54.1
GPA	2.5 - 2.99	14	37.8
	3 – 3.49	13	35.1
	3.5 and more	10	27.0

At the beginning, MI was explained to the participants, and samples of educational MI were presented to them. After four weeks, they submitted the motion infographic and answered the questionnaire.

Results and discussion

The questionnaire reliability for total items was .957 Cronbach's alpha. Table 2 shows the reliability for the whole questionnaire and the four categories.

Table 2

Cronbach's alpha for the questionnaire

Category	Cronbach's alpha
Total questionnaire	.957
Producing MI	.888
Effect on students' learning	.908
Effect on teaching	.859
Using MI in future	.906

Descriptive statistic was conducted to answer question 1 "*what are the students-teacher's opinion about using MI as an instructional media in teaching science to middle and secondary grade levels?*" The results showed that the pre-service science teacher's opinion is in the direction of the favor to the MI (M = 3.65, SD = .548) table 3.

Table 3

Mean scores for the questionnaire

Category	*n*	Mean	Std. Deviation
Total score	37	3.65	.548
Producing MI (Q 1.1)	37	3.38	.640
Effect on students' learning (Q 1.2)	37	4.30	.533
Effect on teaching (Q 1.3)	37	3.74	.599
Using MI in future (Q 1.4)	37	3.48	.693

To have more details about their opinion, question 1 was divided into four sub-questions covering four categories. As for question 1.1 "*What is the pre-service science teacher's opinion about producing educational MI for science topics to middle and secondary grade levels?"* table 3 shows that the participants' opinion for producing the MI for science topics in middle and secondary grade levels is closer to neutral (M =

3.38, SD = .640). This statical result would be best explained with reference to the researchers' observations of the students when they were working in class, and from students' replies to the open-ended question (27 participants replied to this category). Some of them showed difficulty in synchronizing the sound with the animated picture. This problem occurred with the students who needed to synchronize different sound's files with different animations in the same slide, although this was explained to them during the training sessions. The participants stated that they used PP for doing presentations only and did not use sounds; thus, this could be a reason behind the difficulty they faced in synchronizing the sounds with animations. This result is consistent with Fadzil (2018) study that showed that the pre-service science teachers faced challenges while producing infographics. However, many of them commented that they have learned a new skill in PP that will help them in the future.

Almost all participants said that it takes time to produce MI and they wished they had more time; this again conforms with Fadzil (2018) views that the pre-service science teachers said that the production of MI is time consuming. Most of the participants suggested some recommendations to this problem. They recommended that the Ministry of Education should produce the MI. They said they can use MI available on YouTube site, or using other applications specialized in MI production other than PP.

Also, it can be argued that this is the first students' encounter with the MI, and the first time to they produce it. They did not have a choice to choose the application to produce MI, as they were directed to use only PP. Therefore, getting more familiar with MI and having different choices to

produce would reduce the time and the problems they face when producing MI. Participants who finished the "Comp. Edu" course commented that this course should teach them MI production. This result is consistent with that of Islamoglu et al. (2015) and Afify (2018) who recommended that pre-service teachers should be exposed and trained on infographic. Similarly, Baglama et al. (2017) recommends training special education teachers in using infographics to enhance learning. Also, Tarkhova et al. (2020) emphasized the importance of teacher's technology competence for producing infographics.

Results of question 1.2 "*What are the students-teacher's opinion about the effect of educational MI on students learning science in middle and secondary grade levels?*" show that the participants agreed that the MI has a positive effect on student's learning science in middle and secondary grade levels (M = 4.30, SD = .533). More than half (n = 20) of the participants added comments in the open-ended question for the MI effect on the student's learning. Most of them said that MI is a good summary for the topic as it focuses on the important information and helps the students remember it. This result coincides with that of Ozdamli, et al. (2016) who found that students easily recalled the information due to the use of infographics as data was simplified. Many of the participants said that they would use the MI at the end of the lesson or as a summary for revision, a finding similar to that of Dashti and Alhadad's study where students mentioned that they enjoyed the MI since it is a summary of the textbook.

As for the question 1.3 "*What are student-teacher's opinion about the effect of educational MI in teaching science for middle and secondary grade levels*?", most participants agreed that MI has a positive effect on teaching science topics for middle and secondary grade levels (M = 3.74, SD = .599) as

has been shown in table 2. Most of the participants (*n* = 22) replied to the open-ended question for this category. Most of them said that MI may save time and teacher's efforts in class as it presents important information with visuals in a shorter time frame. They would like it to be available for students out of class time on the web. Again, these results are similar to those of Dashti & Alhadad as their students said that they would like to have copies of MI on YouTube in order to watch it anytime and anywhere. Few of the participants replied that science topics in secondary grades are loaded with information, therefore MI will not be suitable for them. They preferred the teacher's explanation and textbooks for secondary schools.

Finally, question 1.4 "*What are the student-teacher's opinion about using educational MI for teaching science in middle and secondary grade levels?*" shows that the participants are more neutral (*M* = 3.48, *SD* = .693) for using MI in the future for science topics in middle and secondary grade levels, since the participants did not have the teaching experience; therefore, they are not able to form an opinion about the use of MI in the future. Less than half of the participants (*n* =15) replied to the open-ended question for this category. The comments focused on one main point that MI may not be suitable for all science topics, especially the secondary grade level. Therefore, they would like to use textbooks as the main source and use the MI as supporting material.

To answer question 2, "*Are there any significant differences between students-teacher's opinions using MI as an instructional media in teaching science to middle and secondary grade levels if whether they have or have not completed the "Computer in Education" course (Comp. Edu*)"? it is worth mentioning that the "Comp. Edu." course is a compulsory course for all students

registered in the College of Education. This course teaches them how they use digital devices and some applications in teaching, and PP is one of them. A t-test was conducted to answer question 2. There were no significant differences in the scores as shown in table 4. Although the overall questionnaire scores for the students who have completed the "Comp. Edu" course (*M* = 3.71, *SD* = .426) is higher than the scores of those who haven't completed the "Comp. Edu." course (*M* = 3.57, *SD* = .668), t (35) = -.779, *P* = .459, the finding is not significant. Similarly, the two groups' opinions regarding the four categories is also, insignificant as shown in table 4.

Table 4

The effect of completing computer in education course on pre-service science teacher's opinion using motion infographic as an instructional media

Category	Finished comp. edu.	n	Mean	std	t	df	P-Value
Total	NO	17	3.57	.668	-.779	35	.459
	Yes	20	3.71	.426			
Producing MI	NO	17	3.30	.753	-.619	35	.551
	Yes	20	3.44	.536			
Effect MI on Learning	NO	17	4.31	.654	.139	35	.890
	Yes	20	4.28	.421			
Effect MI on Teaching	NO	17	3.65	.710	-.789	35	.450
	Yes	20	3.80	.491			
Use in Future	NO	17	3.34	.797	-1.08	35	.285
	Yes	20	3.59	.586			

$*p < .05$

Many participants commented in the open-ended question and almost all participants during the training sessions mentioned that they use PP for presentations only, therefore, they were not familiar with many of the skills that they learned during the production of MI. This shows that the students who completed the "Comp. Edu." course do not have more skills of PP than the ones who did not finish the course; therefore, there was no significant results. Also, all the participants were

trained on the important skills of PP for MI production by one of the researchers. During the production phase, the participants were supervised by the researchers and they were directed as needed. This shows the importance of training the teachers or pre-service teachers on any new technology or application that will be used in teaching or learning. Also, it is important to supervise and direct them when producing any new instructional material. This supports Tarkhova et al.' (2020), Islamoglu et al.' (2015), and Shahin' views, (2020) who emphasized the importance of training teachers and pre-service teachers on the production of infographic.

To answer Question 3 "Are there any significant differences between students-teacher's opinions using MI as an instructional media in teaching science to middle and secondary grade levels regarding their GPA?", an ANOVA analysis was conducted. The results in table 5 shows that the GPA had no significant effect on students-teacher's opinions about MI as an instructional media. The results of the total opinions of participants regarding the GPA is $F(2, 34) = 1.02$, $p = .371$. The participants' opinions about the MI production regarding the GPA is $F(2, 34) = .527$, $p = .595$. As for the participants' opinion of the effect of the MI on students' learning regarding the GPA, the result is $F(2, 34) = 2.02$, $p = .149$. The results of their opinions about the MI and its effect on teaching science regarding the GPA is $F(2, 34) = .575$, $p = .568$. Finally, their opinions about using the MI in the future regarding the GPA variable is $F(2, 34) = 1.58$, $p = .222$. The above results show that all the participants were not familiar with MI. Therefore, no matter what is their GPA they need to be trained to produce MI for a science subjects and how to employ it in teaching.

Table 5

The effect of GPA on pre-service science teacher's opinion using motion infographic as an instructional media

Category		Sum of Squares	df	Mean Square	F	Sig.
Total	Between Groups	.613	2	.306	1.022	.371
	Within Groups	10.194	34	.300		
	Total	10.807	36			
Producing MI	Between Groups	.443	2	.222	.527	.595
	Within Groups	14.279	34	.420		
	Total	14.722	36			
Effect MI on Learning	Between Groups	1.083	2	.542	2.02	.149
	Within Groups	9.136	34	.269		
	Total	10.219	36			
Effect MI on Teaching	Between Groups	.422	2	.211	.575	.568
	Within Groups	12.483	34	.367		
	Total	12.906	36			
Use in Future	Between Groups	1.466	2	.733	1.58	.222
	Within Groups	15.814	34	.465		
	Total	17.280	36			

Conclusions and recommendations

The pre-service science teachers' opinions were more toward the favor of MI. Their opinions would be more positive if they were more acquainted with the apparatus, more trained, and have given a choice of the application which they can use to produce the MI. Therefore, the College of Education should consider training the pre-service science teachers on the production and the use of MI in education. Also, the Ministry of Education should consider implementing the production of MI for different subjects and different grade levels and make them available for the teachers and students on the web.

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