ISSN: 2148-9955

International Journal of Research in Education and Science (IJRES)

www.ijres.net

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To cite this article:

Kotluk, N. & Kocakaya, S. (2017). The effect of creating digital storytelling on secondary school students' academic achievement, self efficacy perceptions and attitudes toward physics. *International Journal of Research in Education and Science (IJRES), 3*(1), 218-227.

IJRES International Journal of Research in Education and Science
Volume 3, Issue 1, Winter 2017 ISSN: 2148-9955

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Article Info

Article History

Received:
14 September 2016

Accepted:
27 December 2016

Keywords
Digital storytelling
Technology in education
Achievement
Physics
Self-efficacy

Abstract

The purpose of this study is to examine the effect of Digital Storytelling (DST) on the (a) academic achievement, (b) attitude towards physics and (c) self efficacy perception of secondary school students. This study consists of an experimental group and a comparison group which are formed by equal number of students. The six-weeks study adopted a pretest and posttest experimental design involving 64 students in two physics classes taught by the same teacher. Digital story telling was additionally applied in experimental group. Non-parametric Tests have been used in the data analysis. Our findings indicate that DST participants performed significantly better than comparison group participants in terms of physics achievement. While in comparison group students' self-efficacy perceptions and attitudes toward physics decreased, in experimental group there was not any difference.

Introduction

Technology has become a significant part of educational activity in 21st century. In this century, learning is facilitated by means of mobile instruments, online application, and social media tools (Yang and Wu, 2012). Hence, so as to make learning more effective, there is a need for new approaches, methods, and techniques which enable to generate rich-learning environments backed up with technologic tools and software based on student-centered education. One of these powerful approaches may be digital storytelling which has been practiced abroad actively, but not recognized adequately in Turkey yet.

Digital Storytelling-DST

Digital storytelling is seen as promising to equip students with various skills involving critical thinking, information, and technology literacy in learning-instruction environment (Yang & Wu, 2012). Digital storytelling influences controlling learning process, focusing on learning, taking responsibility, learning motivation, and self-expression. Moreover, in each digital story students take advantage of sources such as books and internet in order to gather information, images, music which could embellish their narrations. Thus, they not only achieve the learning objectives but also foster such skills as critical thinking, technology literacy, and researching (EDUCAUSE Learning Initiative, 2007).

When the literature related to digital storytelling is reviewed, a large number of definitions could be found; according to Porter (2004), digital storytelling is the activity of incorporating personal story with images, graphics, music, and personally voiced narration. Dupain and Maguire (2005) also defined digital storytelling as creating a story by combining multimedia elements like visuals, audio, video, and animation while it was described by Chung (2007) as multimedia presentation of digital components such as text, images, audio and video in computer environment as a whole. However, digital storytelling is generally regarded as production of an authentic story about a theme through the use of multimedia sources/ tools (Nguyen, 2011; Robin, 2008). Almost all digital stories are formed by synthesizing elements such as graphics, text, voiceover, video, and music that are relevant to a particular subject (Robin, 2006).

Digital stories are short videos created by integrating visual, video background music and written or audible narration with personal story through some basic software and hardware (Microsoft Photo Story, Windows

Movie Maker, Wevideo, Web 2.0 etc.) which can be easily used even by the people who have low technology literacy (Wang & Zhan, 2010). But digital storytelling is not just a PowerPoint presentation (Dreon, Kerper & Landis, 2011). Robin and Pierson (2005) indicated that it is meaningfully built-narration that reflects the power of imagination. Digital stories can also be used with the intention of informative, instructive, demonstrative or personal narration (Robin, 2008). In educational field, digital storytelling could be applied in many fields of science as well as on many topics ranging from historical events to personal stories (Coutinho, 2010).

Process of Digital Storytelling

In the process of generating digital story students choose a topic, carry out research on this topic, develop a script using the information obtained from the research and produce an interesting story compiling all of them as a whole. Then they create a video integrating this authentic script with different kinds of multimedia components such as images, graphics, visual, audio, video, script or text and music. Finally, the video turns into a short video that can be viewed on computer or web environment (Robin, 2008). After being viewed, digital stories are evaluated by the students.
In the process of creating a digital story, there are seven necessary key elements (Robin, 2006; Lampert, 2007). These are:

1. Point of View : Main point in the story and perspective of narrator.
2. A Dramatic of Question : A key question that will be answered at the end of the story.
3. Emotional Content : An issue that connects audience to the story.
4. Gift of Your Voice : Voiceover to help audience personalize and understand the context.
5. The Power of Soundtrack : Music that support and embellish the story.
6. Economy : Using enough content without overloading the viewer.
7. Pacing : How slowly or quickly the rhythm of the story progresses.

Relationship of Digital Storytelling with Education, Academic Achievement, Self-Efficacy, and Attitude

In recent studies regarding learning-instruction environment, one of the most emphasized points is the creation of more supportive and effective environment compared to that of traditional methods (Bromberg, Techatassanasoontorn and Andrade, 2013). Therefore, researchers seek new methods and techniques. This search is generally regarded as a modern learning approach. Because digital storytelling enables teachers and students to become active learners and acquire technologic opportunities of 21st century, it is viewed as one of these methods (Quigley, 2013). In addition, one of the fundamental purposes of digital storytelling is to foster active learning in teaching-learning environment consistent with principle that 'Individuals take responsibility of personal learning experience in rich-learning process (Bromberg et al., 2013). Digital storytelling is an educational activity in accordance with constructive learning approach and leads the learners to acknowledge what is learning and to benefit from deep learning tools (Banaszewski, 2005). The convergence of student-centered learning with digital storytelling is shown in Figure 1 as stated by Barrett (2005):

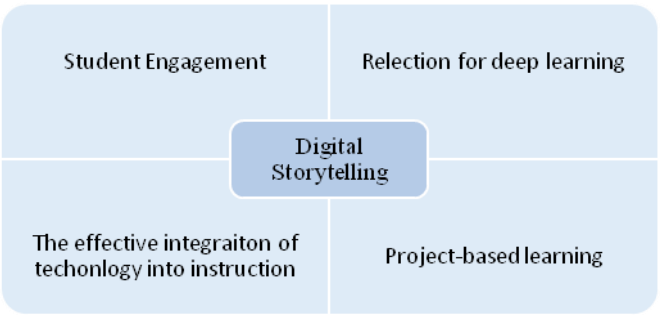

Figure 1. Integration of student-centered approaches into digital storytelling

Besides teachers, students can also bring out authentic digital stories consistent with the principle of 'learning by doing or experiencing'. Some educators who produce their own digital stories could use them to convey new information to their students as well (Robin, 2006; Dogan, 2007). Especially digital stories about learning demonstrate what the students researched and learned through image, audio, and narration. Moreover these stories are the products of individual's authentic learning tasks (Garrety, 2008). It is also clear that practice of digital storytelling is a powerful and remarkable deep-learning tool. This instruction-integrated material influences various kinds of perceptions, skills, and motivation ranging from cognitive processes to affective characteristics as well as from critical thinking to self-efficacy (Robin, 2006). Amongst these affective

characteristics, self-efficacy perception, and attitudes are matter of great importance. For example, associated with the concept of self-efficacy, Bandura (1988) indicated the factors affecting learner's belief in their abilities (self-efficacy) as (a) Experience or 'Enactive Attainment', (b) Modeling or 'Vicarious Experience', (c) Social Persuasion and (d) Physiological Factors. Bandura (1988) also stated that the foremost factor is the first-hand experience actively performed by the learner. The experience that meets expectations and results in success could improve self-efficacy. On the other hand, studies concerning attitude which is one of crucial affective characteristics like self-efficacy have shown that there are positive correlations between attitudes and academic achievement (Cannon and Simpson, 1985; Oliver and Simpson, 1988; as cited in Kocakaya, 2008). Therefore, digital stories can be used as an effective method so as to improve self-efficacy and attitudes in terms of digital storytelling process and its benefits in educational field.

In today's technology-integrated education, as indicated by Banaszewski (2005), using technology in a meaningful way has become a critical part of classroom setting, as a consequence practice of implementing digital storytelling in instruction of many fields has become widespread and this learning situation is also noted by many researchers, educators, and instructors. Since educators began to try various kinds of digital narration in 1990s, digital storytelling has developed. Digital storytelling gives people opportunity to produce their own stories and share them by using technology and media, and so digital technology and social media enable today's teachers not only to publish authentic stories but also to review and evaluate other stories (Garrety, 2008). With respect to its benefits, digital storytelling has been used in many fields involving science, social science, language teaching, and literacy.

Digital Storytelling and Physics

In retrospect, digital storytelling has been generally used about social, cultural, and linguistic matters in learning-instruction environments (Banaszewski, 2005; Yang & Wu, 2012; Demirer, 2013). When the related literature is reviewed, it is clear that there are few studies about digital storytelling in physics instruction. Hence, this situation necessitates implementing studies on digital storytelling in physics instruction. According to Andree (2005), students could realize the events related to physics from daily life thanks to digital stories and construct knowledge by exploring relationship between them. Because the students find more instances from daily lives, also develop emotional attachment to learning material, they are motivated and reconstruct information more easily through processing former knowledge.

Regarding physics instruction, Kahraman (2013) stated that the use of digital stories about physics has a meaningful and positive impact on motivation and students' achievement and Matthews-DeNatale (2008) suggested that digital storytelling could be used in science instruction, meanwhile Hung, Hwang and Huang (2012) added that digital storytelling enhanced motivation, achievement and problem-solving skill in science instruction. Kotluk and Kocakaya (2015), Karakoyun, Kocakaya and Kotluk (2016), Kocakaya and Kotluk (2016) in their studies determined that the creating, designing and developing physics digital stories have positive effect on high school students' and pre-service physics teachers' 21st century skills such as creativity, intra and inter personal relations, critical thinking, and DST can enhance motivation, attitude and interest toward physics.

Despite the effectiveness and advantages of digital storytelling process, this method is not adequately known and thus hardly used in physics except few studies in Turkey (Kahraman, 2013; Kotluk and Kocakaya, 2016a;2016b;Karakoyun, Kocakaya and Kotluk 2016). Moreover it is argued that in physics instruction by means of such methods as digital storytelling which enables students to become active learners and take responsibility of learning tasks, students could take advantage of multimedia tools and utilize computer and internet more efficiently in learning-instruction environment. Consequently it is needed to carry out this study about digital storytelling in physics instruction.

Purpose of the Study

The purpose of this study is to find out the impact of using digital storytelling about the unit of modern physics on (a) academic achievement, (b) physics attitudes and (c) self-efficacy perceptions of 10^{th} grade high school students. Accordingly, this study seeks to answer sub-questions below:

1. Is there any statistically significant difference between experimental and comparison groups' attitudes towards physics, modern physics achievement test and self-efficacy perceptions on their pretest results?

2. Is there any statistically significant difference between experimental and comparison groups' attitudes towards physics, modern physics achievement test and self-efficacy perceptions on their posttest results?
3. Is there any statistically significant difference between pretest and posttest results of experimental and comparison groups' scores obtained from physics attitude scale, modern physics achievement test and self-efficacy perception scale.

Method

Research Design

In this study, Pre-test and Post-test Experimental Design involving experimental and comparison groups was used. Research design is given Table 1.

Table 1. Quasi-experimental design with pre-test-posttest comparison group

Group	Pretest	Task	Posttest
Experiment	T1	Digital Storytelling	T2
Control	T3		T4

Population and Sample

The population of the study was limited to all secondary school students in center province of Van in Turkey in 2013-2014 academic year for the convenience. As for sampling, 64 10^{th} grade students (32 in experimental group and the other half in comparison group) who had physics course in spring semester of 2013-2014 academic year were chosen according to convenience sampling. The study was undertaken in a public high School since it was supportive of this study and had appropriate facilities.

Data Collection Tools

In this study, Modern Physics Achievement Test (MPAT) was used in order to determine achievement of students. Based on revised Bloom taxonomy, MPAT was developed by researchers through test item analysis and it includes 22 questions. A team of two physics instructors, three experienced physics teachers and a curriculum development expert cooperated to accomplish content validity of Modern Physics Achievement Test (MPAT). Additionally, with regard to reliability of MPAT, Spearman-Brown split-half test was employed to the students and reliability co-efficient was α=,766. Physics Attitude Scale (PAS) was used in evaluating participants' attitude towards physics. Physics Attitude Scale (α =,730) including 24 propositions was developed by Özyürek and Eryılmaz (2001) and validated by Kocakaya (2008). As to defining students' self-efficacy perceptions, Physics Self-Efficacy Perception Scale (PSSS) developed by Maskan (2006) was used (α =,666) and it includes 11 propositions. The reliability of the PAS and PSSS were re-evaluated for this study and calculated 0,840 and 0,790 respectively.

Research Procedures

The duration of the study was 6 weeks between April and May 2014 with two groups involving 64 students. An experimental group with 32 students and a comparison group with 32 students were determined prior to application of the method. Afterwards, Modern Physics Achievement Test (MPAT), Physics Attitude Scale (PAS) and Physics Self-Efficacy Scale (PSS) were applied to both experimental and comparison groups as pretests. The outline of the application is shown in Table 2.

Table 2. The Outline of Application in Experimental Group

1st week	Inform about the process	Introduce DST procedures, Show the self-made digital story	Introduce Windows Movie Maker
2nd week	Review Modern Physics Unit and choose an interesting topic	Explain reasons for choosing the issues	Content Scanning Related to Selected Issues
3rd week	Arranging Scripts	Discussion of the Scripts In Groups	Scan for images
4th week	Arrange Images	Sharing Views on Script-Images Harmony	Search for Background Music
5th week	Provide Harmony Audio-Music-Content	Installing Background Music and students' Audio to Video	Upload 3-5 minute Digital Story to the Web Environment
6th week	Watch digital stories uploaded in Web Environments	Share reflections and comments for each Video by the students	Provide Feedback by the owners to the criticism of the videos and Making Corrections

After a six-week application, three tests of MPAT, PAS and PSS were applied to both groups again as posttests. Subsequent to this process, each student created an authentic digital story. A channel named as 'VANGÖLÜ TEKNİK EML DST' was created and subscribing this channel, students uploaded their own digital stories (32 videos on total) and then they evaluated classmates' stories. Meanwhile it was also announced to other students and teachers to view and evaluate student-produced videos from the link https://www.youtube.com/channel/UCTELMYKHjX_ILF-xCjpa-Q so as to generate interest in all students (participated or not) as well as show that physics can be appealing. View rates of these videos indicated that this aim was achieved to some extent. Besides, students were allowed to share digital stories in social media such as Facebook, Twitter and so on.

Data Analysis

For the analysis of data, obtained from MPAT, PAS and PSS, Mann-Withney U and Wilcoxon Signed Rank Tests have been used. Accordingly, significance level was determined as 0.05 in statistical analyses executed in.

Results and Discussion

Data obtained from pretests analyzed with Mann-Withney U Test are shown in Table 3.

Table 3. Pretest results according to self-efficacy, attitude, and achievement

Variable	Group	N	Mean Rank	Sum Rank	U	p
Self-efficacy	Experimental	32	30.53	977.000	449.0	.396
	Control	32	34.47	1103.00		
Attitude	Experimental	32	30.95	990.500	462.5	.506
	Control	32	34.05	1089.50		
Achievement	Experimental	32	23.95	766.500	238.5	.000*
	Control	32	41.05	1313.50		

According to results given in Table 3, there was no significant difference between experimental and comparison groups' attitudes and self-efficacy scores before the application, besides this, there was a significant difference in favor of comparison group's achievement. Wilcoxon Signed Rank Test results in regard to whether there is a significant difference between self-efficacy, attitude, achievement of experimental and comparison groups before and after the application are given in Table 4.When the Table 4 is examined, it is seen that there was no significant difference in self-efficacy and attitude scores of experimental group, however there was a significant difference in achievement scores of experimental group. In addition, the difference observed in achievement scores was in favor of positive rank or posttest when sum and mean ranks of difference scores were considered.

In the analysis of data, it is clearly seen that there was a significant difference between pretest and posttest of the comparison group's self-efficacy, attitude, and achievement scores. As sum and mean ranks of difference scores are taken into account, it appears that the difference in achievement scores was in favor of positive rank, that is, posttest while the difference in self-efficacy and attitude scores are in favor of negative rank, that is, pretest.

Table 4. Test Results of MPAT, PAS and PSS scores obtained from experimental and comparison groups

Groups	Posttest Pretest	N			Mean Rank			Sum Rank			z	p
		Neg	Pos	Equal	Neg	Pos	Equal	Neg	Pos	Equal		
Experiment	Self Efficacy	15	17	0	14.57	18.21	-	218.5	309.5	-	0.852	0.394
	Attitude	11	20	1	17.09	15.40	-	188.0	308.0	-	1.177	0.239
	Achievement	0	32	0	00.00	16.50	-	00.00	528.0	-	4.944	0.000*
Control	Self Efficacy	22	9	1	16.64	14.44	-	366.0	130.0	-	2.316	0.021*
	Attitude	29	3	0	16.74	14.17	-	485.5	42.5	-	4.144	0.000*
	Achievement	1	30	1	11.00	16.17	-	11.0	485.0	-	4.657	0.000*

Results obtained from Mann-Whitney U Test are shown in Table 5.

Table 5. Mann-Whitney U Test results according to posttests of self-efficacy, attitude and achievement

Variable	Group	N	Mean Rank	Sum Rank	U	p
Self-efficacy	Experiment	32	38.03	1217.0	335.0	.017*
	Control	32	26.97	863.0		
Attitude	Experiment	32	40.98	1311.5	240.5	.000*
	Control	32	24.02	768.5		
Achievement	Experiment	32	37.22	1191.0	361.0	.040*
	Control	32	27.78	889.0		

It is found that Self-efficacy, Attitude, and Achievement of experimental and comparison groups differed significantly after the application when scores in Table 5 are examined. Regarding posttests of both groups, self-efficacy, attitude, and achievement of experimental group differed significantly and positively than those of comparison group. Mann-Whitney U Test results indicating whether there is a significant difference between self-efficacy, attitude, and achievement of experimental and comparison groups according to their gain scores after the application are given in Table 6.

Table 6. Mann-Whitney U test results according to pre-test and post-test differences in self-efficacy, attitude and achievement of experimental and comparison groups

Variable	Group	N	Mean Rank	Total Rank	U	p
Self-efficacy	Experiment	32	37.28	1193.0	359.0	.040*
	Control	32	27.72	887.0		
Attitude	Experiment	32	42.02	1344.0	207.5	.000*
	Control	32	22.98	735.5		
Achievement	Experiment	32	42.72	1367.0	185.0	.000*
	Control	32	22.28	713.0		

Data analyses considering gain scores (difference between pre-test and post-test) are clear indication that there was significant difference in self-efficacy, attitudes, and achievement of experimental group after they resorted to the application of the method. Accordingly, it is apparent that the difference in self-efficacy, attitude, and achievement of experimental group was more significant and positive than those of comparison group.

Discussion

In this section, the findings obtained from this study about the impact of digital storytelling on self-efficacy, attitude, and academic achievement of students were analyzed and discussed.When the Table 3 is examined, it is obvious that there was no significant difference between self-efficacy, attitude of experimental, and comparison groups before the application while there was a significant difference between achievement of experimental and comparison groups before the application. Accordingly, this difference was in favor of comparison group. Indeed it can be added that readiness of comparison group about modern physics was higher than that of experimental group before the application.As shown in Table 4, when self-efficacy, attitude and achievement of comparison group were compared in terms of pre-test and post-test (application of method), there seemed a significant difference. When we look at mean ranks, findings show that the method applied on comparison group had significant and positive impact on achievement while affecting self-efficacy and attitude negatively in a meaningful way. This negative change in affective characteristics of comparison group in such relatively short

space of time may stand to reason that 'modern physics' unit includes a large number of abstract concepts and thought experiments. Besides, another reason may be the method applied on comparison group. Nevertheless, Aydoğmuş, Sarıkoç and Berber (2010) suggested that further long-term researches should be implemented about changes in affective characteristics. It is also surprising that self-efficacy and attitude towards physics differed negatively although achievement level differed positively in comparison group. Because it is generally argued in the related literature that self-efficacy and attitude are directly proportionate to achievement and thus high or low levels of self-efficacy and attitude influence achievement evenly (Hall & Ponton, 2005; Shih & Alexander, 2000). On the other hand, Kocakaya (2008) pointed out in his study that amongst the affective characteristics, self-efficacy perception and attitude towards physics may not possibly have a clear effect on achievement as stated in related literature.

When Table 4 is examined again, it is seen that there was a significant and positive difference only in achievement in terms of self-efficacy, attitude and achievement of experimental group before and after the application. According to results, digital storytelling applied to experimental group had a significant and positive impact on achievement. Yet, there was no noteworthy difference in self-efficacy perceptions and attitudes towards physics and this may be because of the fact that duration of application was short and the change in affective characteristics takes long time. Indeed, this was an expected outcome owing to the fact that many studies concluded that the students' self-efficacy perceptions and attitudes did not change in a short span of time (Gönen & Kocakaya, 2005, Gönen, Kocakaya & Inan, 2006). All the same, considering the studies about the relationship between digital storytelling and affective characteristics in some lessons other than physics (Xu, Park & Baek, 2011; Heo, 2009), it was stated that digital storytelling improved students' self-efficacy. Besides, Yoon (2013) and Demirer (2013) deduced that the application of digital storytelling contributed to students' attitude towards learning though there was no difference in attitudes of experimental group in this study. According to Barrett (2005), digital storytelling improves in-depth learning, real engagement, and motivation. As there are only few studies about the impact of digital storytelling on self-efficacy and attitude and this study had relatively short span of experiment, there is a need to conduct more studies so as to yield a clear result on this issue.

Posttest findings in Table 5 emphasize that self-efficacy, attitudes, and achievement of experimental group showed a more significant and positive difference than those of comparison group. As a result, it can be inferred that the method utilized in experimental group was more effective on self-efficacy, attitude, and achievement than the one used in comparison group. There was a decrease in self-efficacy and attitude levels of comparison group, however no significant difference was observed in self-efficacy and attitude levels of experimental group. So it can be possibly suggested that digital storytelling was more effective on affective characteristics of experimental group compared to comparison group. In light of gain scores (difference between pretest and posttest) in Table 6, it was observed that the significant and positive difference was in favor of experimental group in terms of self-efficacy, attitude, and achievement of both groups. This also reinforced the findings that digital storytelling applied on experimental group was more efficient than the method used in comparison group. Whereas self-efficacy and attitudes of the comparison group changed negatively due to abstract concepts in the unit 'Modern physics' or other reasons, this negative indication was not seen in the experimental group. Similarly, as Yang and Wu (2012) stated, digital storytelling improved academic achievement, critical thinking, and learning motivation positively and Wang and Zhu (2010) found out that students who were educated by digital storytelling actively involved in learning and had more positive learning motivation as well as enriched problem-solving skill while Hwang and Huang (2012) saw that the use of digital storytelling in physics improved learning motivation, problem-solving skill, and academic achievement significantly. Kotluk and Kocakaya (2015), Karakoyun, Kocakaya and Kotluk (2016), Kocakaya and Kotluk (2016) in their studies determined that the creating, designing and developing physics digital stories have positive effect on high school students' 21st century skills such as creativity, intra and inter personal relations, critical thinking, and DST can enhance motivation, attitude and interest toward physics. In his study, Kahraman (2013) indicated that digital stories about physics produced more effective contributions than as-usual instruction based on curriculum in both long term and short term.

The reason why the students thought that DST could have a positive effect on their learning-teaching process may be owing to the fact that DST encouraged them to learn by doing and researching, which makes them continuously active in the process (Razmi, Pourali & Nozad, 2014) and makes them take responsibility for what their learning was, and that such multimedia elements as video, audio, visual, music etc. fostered their learning. The findings of this study supported the findings obtained by Xu, Park and Baek, (2011), Yang and Wu, (2012). Also, Dogan and Robin (2008) claimed that through the use of digital stories, students became active learners and their motivation in learning increased significantly. The same was stated by Hung, Hwang and Huang (2012).

Conclusion

In the light of results obtained from this study, it is suggested that the application of digital storytelling in physics lesson have a positive impact especially on students' achievement and as to self-efficacy and attitude, it is beneficial and necessary. The difference observed in self- efficacy, attitude, and achievement is also expected to foster students' various skills. By the way of this study which tried to give insights about effects of using digital storytelling, it is recommended that further studies should try to explore the effects of digital storytelling in physics on critical, reflective, creative thinking, learning motivation towards physics as well as problem-solving skill. As a matter of fact, Hathorn (2005) stated that digital storytelling is a highly appropriate method for constructive learning approach and enhances learning motivation and students' engagement in learning in addition to providing transformative experience of success for students. Whereas Tsou, Wang and Tzeng (2006) found that digital stories increased achievement and whet students' appetite for learning, Doğan and Robin (2008) submitted that through use of digital stories, students became active learners and attained high learning motivation. According to Sadik (2008), digital storytelling enables students to personalize learning content, improve collaboration and communication skills and use technology in a meaningful way. What is more, digital stories enhances students' self-confidence in learning English in addition to motivation and interest. The follow-up studies about the use of digital storytelling in other fields (science, social science, language learning and literacy) may also bring out more profound outcomes.When we regard students' achievement and interest in physics lesson in particular and their views on physics in general, it seems that digital storytelling may reduce concerns about physics somewhat. Indeed, view rates of 32 videos shared in Youtube channel may be an indication of this assumption. Similarly, as stated by Blas, Garzotto, Paolini and Sabiescu (2009) digital storytelling allows the students to gain interest in subject matters that mostly seem dull.

In the process of digital storytelling, students come up with an idea and they research, explore and learn about this idea, afterwards they write a script using the information gathered and create an authentic story. After gathering images, audio and graphics students blend their own story with these multimedia elements and finally create a short video that can be viewed in web or computer environment. Certainly this process involving worthy and authentic learning tasks may contribute to students' self-efficacy, attitude, and academic achievement. Hence the practice of combining digital storytelling into physics lesson will foster active learning and meaningful knowledge. Such applications are suggested to be applied to students at least for/during a school term. Indeed, not only students but also teachers can actively involved in learning and instruction with help of digital stories. There is a need to conduct further studies about the effect of digital storytelling on physics instruction. In this study, cooperative learning was used in comparison group. As a matter of fact, in the follow up studies, modern learning methods can be compared with digital storytelling method. Wider sample group may also resort to similar researches. In addition, similar studies can be employed to students, pre-service teachers, teachers and instructors in different level of education. Overall, the duration of this study was 6 weeks and digital stories were only about "modern physics" unit. Considering the impact of digital storytelling on affective characteristics and the assumption that change of affective characteristics requires considerable time, it is suggested that the application process in further studies should be planned for a longer span of time in order to obtain more precious results in regard to the impact of digital storytelling on affective characteristics.

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