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Effects of Learner-created Digital Storytelling on Academic Achievement, Creativity, and Flow in Higher Education*

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The purpose of this study was to examine the effects of using learner-created DST to communicate academic information on the creativity and flow of university students. The sample consisted of 100 undergraduate students who were assigned to either the DST group or the expository instruction group. The DST group created digital stories, and the expository group were taught using an expository instructional method. An achievement test, the Creativity Personality Scale (CPS), and the Flow State Scale (FSS) were used to collect data. The results showed that the achievement scores of the DST group were higher than those of the expository group, and the scores on the patience sub-factor of the CPS of the DST group significantly differed from those of the expository instruction group. Finally, the scores on the seven sub-factors of the FSS of the DST group differed significantly from those of the expository instruction group. The findings of this study suggest that the DST can be applied as teaching and learning method in a university class.

Keywords: Digital storytelling, Higher education

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Introduction

In the technology-rich societies of the 21st century, digital storytelling (DST) has emerged as a research area focussed on the educational potential of both formal and informal learning environments (Malita & Martin, 2010). The 21st-century educational system prioritises creativity as a one of the essential competencies (Trilling & Fadel, 2009) because this capacity plays a crucial role in global society and prepares students to cope with future social changes (Batchelor & Bintz, 2013). DST has been proposed as a way to promote creativity by applying technology (Quinn, Bederson, Bonsignore & Druin, 2009).

Researchers and practitioners have conducted studies related to DST, including the appropriate procedures and guidelines for its use as an instructional method (Hung, Hwang & Huang, 2012; Kwon, 2008; Tackvic, 2012), the effects of DST content (Suwardy, Pan & Seow, 2013), and the impact of learner-generated digital storytelling (Cho & Lee, 2012; Mellon, 1999; Ohler, 2013; Sadik, 2008). A review of the relevant literature yielded the following three observations. First, research on learner-created DST could be classified according to whether its focus was on curricular or extra-curricular activities. Almost all studies were focussed on the curricular activities of K–12 students. Second, experimental research on the use of DST in education has been burgeoning in recent years. Thus, the empirical results reported since 2007 were reviewed. Third, DST has been proposed as an approach to teaching and learning that stimulates creativity (Dupain & Maguire, 2007; Tackvic, 2012). However, scant research on the effects of DST on creativity has been performed. Furthermore, although the notion of flow experience has been one of the main elements of empirical research on creativity, the effects of both creativity and flow have rarely been studied.

Therefore, this study aimed to explore the effects of a learner-created DST approach on creativity, flow, and academic achievement in higher education. More specifically, this research empirically examined the following questions:

1. Do DST and expository classes differ with regard to students' academic achievement?
2. Do DST and expository classes differ with regard to students' creativity-related personality traits?
3. Do DST and expository classes differ with regard to students' experiences of flow?

Literature Review

Digital storytelling

Digital storytelling (DST) is the practice of combining narrative with digital content, images, sound, and video. The purpose of a digital story is the same as that of stories within an oral tradition: to elicit an emotional response and/or to communicate a message to the audience (Malita & Martin, 2010). Meadows (2003) categorised digital stories as short single- and multimedia stories.

Digital stories are classified into three categories: personal narratives, stories that inform or instruct, and stories about historical events (Robin, 2008). Ohler (2013) defined the digital stories used in education as a form of short movie that relied on low-end technology commonly available to students. The briefest definition of DST is that it is the application of multimedia software techniques to the telling of stories (Mellon, 1999). In this study, DST was defined as the use of dramatic digital content to deliver information.

Studies on the use of DST in education have been categorised according to their focus: the procedures of DST, the development of teacher-generated content, and the effect of learner-created content.

In terms of the procedures of DST, Nam and Ka (2014) developed a DST-based instructional model involving three steps: attending a workshop to learn how to

perform DST activities, performing DST learning activities, and sharing and summarising DST activities. Ohler (2013) proposed the following five phases in the development of DST: story planning, preproduction, production, postproduction, and performing/posting/showing/distributing. Kearney (2011) proposed three elements involved in DST: resources, task, and support. He suggested that the task involves preproduction (development of ideas, creation of storyboard/script, preparation of media), production (audio-recording of narrative, editing), post-production (small group viewing), and distribution (internal presentation, wider dissemination) stages.

With regard to studies on the development of teacher-generated content, Suwardy, Pan, and Seow (2013) created DST content for accounting education.

In terms of studies on the effects of learner-created content, researchers have explored the effects of DST on learning motivation (Hung, Hwang & Huang, 2012), problem-solving competence (Hung, Hwang & Huang, 2012) and learning achievement (Hung, Hwang & Huang, 2012; Kwon, 2008), learning-related attitudes (Kwon, 2008), identity expression, and collaborative practices (Ranieri & Bruni, 2013). Sadik(2008) conducted research on DST as an integrated approach to the promotion of student learning using a sample of eight teachers and students (13–15 years of age). The results showed that students performed well and that their stories fulfilled many of the pedagogical and technical standards of digital stories. In addition, teachers believed that DST projects were able to increase students' understanding of the curricular content.

Creativity, flow and digital storytelling

Creativity has been defined in various ways, and debate about its definition continues. However, all definitions agree that creativity is the ability to make something novel (Mumford, 2003; Van Heerden, 2010). The emergence of new media has presented a greater number of choices and challenges with regard to how

to teach and learn. Researchers have argued that DST inspires creativity by allowing students to learn in an environment in which technology is widespread (Dupain & Maguire, 2007; Gakhar & Thompson, 2007). Åkerman and Puikkonen (2013) conducted a study on participant-generated storytelling using technology to compare the creativity of children and adolescents.

DST is the collaboration of the creative and the analytic thinking and practice (Malita & Martin, 2010); it is a creative and artistic endeavour that uses multiple types of media to effectively communicate a story (Ohler, 2013). However, despite researchers' suggestions with regard to using DST to promote creativity, scant research has been conducted in this domain.

Creativity and flow are interrelated (Van Heerden, 2010). Flow is the mental state of complete absorption in an activity (Csikszentimihalyi, 1990), and people are most creative during the peak experience known as flow (Saywer, 2006). Xu, Park, and Baek (2011) examined the effects of DST on writing self-efficacy and flow in a virtual-reality learning environment. The results showed that DST is more effective in a virtual learning environment than it is off-line.

In summary, researchers have suggested that DST can help reveal and improve creativity. However, although creativity is enhanced by the experience of flow, empirical research in this area has rarely been conducted.

Method

Participants

The sample for this study consisted of 100 undergraduate students who majored in Physical Education in two 'Introduction to Special Education' classes which lectured by one instructor. Introduction to Special Education which focuses on various types of learners with special needs and inclusion them into general

education classroom is a required course for pre-service teacher training. One class of 50 students was taught with an expository approach and served as the control group, whereas the other class of 50 students were taught using DST and served as the experimental group. Almost all studies on learner-created DST have been conducted among K–12 students, but this study explored the effects of this approach in higher education.

Procedures

This study was conducted in three stages (preparation, implementation, and analysis), which are described in what follows.

Preparation stage

First, participants in the expository and DST groups completed a pre-test. Second, according to Rowe, Savundranayagam, Land, and Montgomery (2011)'s suggestion, we asked the DST group to perform a task that elicited creativity, encouraged group interaction, and lacked an opportunity to fail. The topic of task was development of digital storytelling about visual and hearing impairments chosen by the participants. Participants in the DST group used a smartphone to take a photo, convert it into a file, and use Windows Movie Maker. Third, we tested the homogeneity between groups.

Implementation stage

First, the DST group was introduced to the topic, its relationship to the curriculum, the process involved in the assigned activity, the schedule to be followed, and the evaluation criteria. Kearney's three stages were used to develop the steps involved in the activity selected. Second, a project team was formed. Third, a peer evaluation paper was distributed. Fourth, the experiment was performed during a 3-week period. Fifth, post-tests were administered to the expository and DST groups.

Table 1. Implementation activities

DST group	Expository group
1) Pre-test 2) Introduction to DST project - topic -relationship to curriculum, -activity procedure and schedule - evaluation criteria 3) Production 4) Post-test	1) Pre-test 2) Teacher's explanation 3) Post-test

Analysis stage

After engaging in the activity, students' academic achievement, creativity and flow were measured. Independent-sample t-tests were performed using the SPSS 19.0 statistics program.

Instruments

Creative Personality Scale (CPS)

The Creative Personality Scale (Ha, 2000; Ha, 2001), which was used to measure creativity, consists of the following eight sub-factors containing 30 items rated on a four-point Likert scale: curiosity, self-confidence, imagination, patience, humour, independence, adventurousness of spirit, and openness of mind. The reliability value of original scale developed by Ha (2000) was around 0.45-0.79. The reliability values for the sub-factors in this study were as follows: challenge–skill balance (.52), action–awareness merging (.62), clear goals (.68), unambiguous feedback (.76), concentration on the task at hand (.72), sense of control (.60), loss of self-consciousness (.46), transformation of time (.46), and autotelic experience (.63). The five sub-factors with reliability values that exceed .60 were analysed in this study. The reliability value of all the items on the five sub-factors was 0.71.

Flow State Scale (FSS)

The Flow State Scale (Jackson & Marsh, 1996) administered in this study is a self-report instrument that assesses the construct of flow. It consists of the following nine sub-factors containing 36 items rated on a four-point Likert scale: challenge-skill balance, action-awareness merging, clear goals, unambiguous feedback, concentration on task at hand, sense of control, loss of self-consciousness, transformation of time, autotelic experience. The instrument was translated into Korean and modified to measure the flow state of the DST and expository groups. Following modification, all items were reviewed by a colleague with Ph.D. in Education. The reliability value of original scale developed by Jackson & Marsh (1996) was around 0.80-0.85. Reliability for the sub-factors in this study was: challenge-skill balance (.52), action–awareness merging (.62), clear goals (.68), unambiguous feedback (.76), concentration on task at hand (.72), sense of control (.60), loss of self-consciousness (.46), transformation of time (.46), autotelic experience (.63). Reliability for total items was .91. Seven sub-factors with reliability above .60 were analysed for this study. The reliability of total items for seven sub-factors was 0.89.

Test of academic achievement

The researcher developed an achievement test based on the course content. An experienced instructor reviewed this instrument to ensure its content/expert validity. The scale consisted of 20 questions, 10 questions of which appeared on the pre-test to test the homogeneity between groups and 10 of which appeared on the post-test.

Results

The main purpose of this study was to examine the effects of DST on the academic achievement, creativity, and flow experience of college students. To this

end, one group created digital stories, and an instructor taught the other group. Students' academic achievement was measured before initiation of the experimental intervention to investigate the homogeneity of the two groups. There was no statistically significant different between two groups (t=.68, p> .05). After the activity academic achievement test, creativity and flow were measured. Independent-sample t-tests were performed using the SPSS 19.0 statistics program.

The groups' scores on academic achievement, creativity, and flow differed significantly: achievement (t=2.925, p< .01), creativity (t=2.647, p< .01), and flow (t=4.151, p< .001). <Table 2> summarises the results of the two independent-samples t-tests on academic achievement, creativity, and flow.

Table 2. Results of two independent-samples t-tests on academic achievement, creativity and flow

	Group	N	Mean	Std. Deviation	t	*p*
Academic achievement	Digital storytelling	50	1.93	.86	2.925	.004
	Expository	50	1.48	.66		
Creativity	Digital storytelling	50	3.07	.38	2.647	.009
	Expository	50	2.76	.37		
Flow	Digital storytelling	50	3.06	.37	4.151	.000
	Expository	50	2.73	.42		

The scores of the two groups on the patience sub-factor of creativity <Table 3> differed significantly (t=3.264, p< .01).

The scores of the two groups on the sub-factors of flow <Table 4> differed significantly with regard to action–awareness integration (t=3.282, p< .01), clear goals (t=2.903, p< .01), unambiguous feedback (t=2.552, p< .05), concentration on the task at hand (t=3.620, p< .001), sense of control (t=2.731, p< .01), loss of self-consciousness (t=2.568, p< .05), and autotelic experience (t=4.658, p< .001).

Table 3. Results of two independent-samples t-tests on sub-factors of creativity

Sub-factors	Group	N	Mean	Std. Deviation	t	*p*
Patience	Digital storytelling	50	2.83	.54	3.264	.002
	Expository	50	2.42	.40		
Self-confidence	Digital storytelling	50	3.46	.46	1.750	.083
	Expository	50	3.28	.53		
Humour	Digital storytelling	50	2.80	.67	1.036	.303
	Expository	50	2.66	.63		
Curiosity	Digital storytelling	50	3.19	.50	1.935	.056
	Expository	50	2.98	.55		
Imagination	Digital storytelling	50	3.20	.56	1.408	.162
	Expository	50	3.02	.74		

Table 4. Results of two independent-samples t-tests on sub-factors of flow

Sub-factors	Group	N	Mean	Std. Deviation	t	*p*
Action–awareness integration	Digital storytelling	50	3.01	0.44	3.282	.001
	Expository	50	2.675	0.56		
Clear goals	Digital storytelling	50	3.18	0.51	2.903	.005
	Expository	50	2.88	0.51		
Unambiguous feedback	Digital storytelling	50	3.05	0.54	2.552	.012
	Expository	50	2.765	0.56		
Concentration on the task at hand	Digital storytelling	50	3.175	0.54	3.620	.000
	Expository	50	2.795	0.50		
Sense of control	Digital storytelling	50	3	0.52	2.731	.007
	Expository	50	2.685	0.62		
Sense of control	Digital storytelling	50	2.87	0.53	2.568	.012
	Expository	50	2.59	0.55		
Autotelic experience	Digital storytelling	50	3.165	0.46	4.658	.000
	Expository	50	2.725	0.47		

Conclusion

Recent advances in technology allow learners in the 21st century to create products that express their thinking and understanding (Gardner & Davies, 2014). DST, which has been proposed as an approach to teaching and learning, uses mobile technology to facilitate the expression of creativity (Dupain & Maquire, 2007; Malita & Martin, 2010; Ohler, 2013).

This study examined the effects of DST on academic achievement, creativity, and flow. Statistical analyses revealed a statistically significant difference in the academic achievement of the two groups, with the mean of the DST group higher than that of the expository group. These results are consistent with those reported by Hung, Hwang, and Huang (2012) and by Kwon (2008) for elementary students.

A statistically significant difference between the groups was also found in relation to the patience sub-factor of creativity, which refers to the tendency to accomplish a task under adverse conditions. According to Kim (2014)'s research on learners' experience with a team project based on DST, a sense of accomplishment was highly valued by participants. In this study, DST group could be a high degree of perception of patience because participants in DST group were needed to create the DST contents, which a sense of accomplishment was mentioned frequently in previous research.

Statistically significant differences between the groups were also observed with respect to the action–awareness integration, clear goals, unambiguous feedback, sense of control, and autotelic experience sub-factors of flow. These results were compared with those reported by Xu, Park, and Baek (2011) with regard to DST in writing class. Their research compared the means for writing efficacy and flow related to DST of learners in a virtual-reality learning environment with those of learners using Windows Movie Maker off-line. They found that the flow scores of the virtual reality group differed significantly from those of students using the Windows Movie Maker off-line. The researchers concluded that the imagination and creativity of students in a virtual reality environment is stimulated because the

writing topic is travelling through spaces and time.

This study has two limitations. First, DST was created as a type of drama for delivering information, and the results may differ when a different type of DST is examined. Moreover, the results could be interpreted in various ways considering task time in DST class and learning time in expository class.

Second, the DST group created their DST as a team project, whereas the expository group received a lecture. Future research should examine the effects of DST using an individual-based pedagogical approach.

This research involved the analysis of quantitative data. Future research should examine qualitative data to explore other aspects of these phenomena.

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