

A New Approach Toward Digital Storytelling: An Activity Focused on Writing Self-efficacy in a Virtual Learning Environment

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ABSTRACT

Recently, computer technology and multimedia elements have been developed and integrated into teaching and learning. Entertainment-based learning environments can make learning contents more attractive, and thus can lead to learners' active participation and facilitate learning. A significant amount of research examines using video editing software to create video clips for digital storytelling activities. However, in this study, we suggest performing digital storytelling in virtual worlds with open-ended, edutainment elements, and place more stress on the writing process. The purpose of this study is to examine the effects of writing for digital storytelling on writing self-efficacy and on flow in the virtual reality learning environment known as Second Life. The researchers organized an activity for undergraduate students to create digital stories. Participants were divided into two groups. One group created their digital stories in Second Life. The other group created their digital stories off-line. The two groups' independent sample t-tests were employed to compare writing self-efficacy and flow. The results of the experiment demonstrate that digital storytelling in a virtual learning environment is more effective than digital storytelling off-line. The findings of this study suggest that the technique of digital storytelling can be used effectively in classroom settings to teach writing.

Keywords

Digital storytelling, Virtual learning environment, Second Life, Writing self-efficacy, Virtual reality

Introduction

Everyone has their stories to tell, and every day we hear from others about their experiences in the form of stories. Storytelling is a quintessentially human experience, whether conveying stories about oneself, others, or about the world (McDrury & Alterio, 2003). The stories can be real or fictitious. Storytelling is widely used in classrooms to enrich the learning experience. Storytelling is a natural method of human communication and is prevalent in all aspects of human social interaction. People tend to make better sense of complex ideas, concepts, or information when it occurs via storytelling (Chung, 2006). In this context, Ibanez et al. (2003), Mello (2001), and Sadik (2008) have said that storytelling can be used to enhance a student's higher-order thinking and literacy skills, thereby increasing collaborative learning. Nowadays, with the rapid development of technology, a new version of storytelling is emerging: digital storytelling. Digital storytelling integrated with powerful technology can be an effective tool to enhance teaching and learning. The educational application of digital storytelling is attracting the attention of many educators (Chung, 2006; Lee, 2005; Robin, 2008; Sadik, 2008; Shin & Park, 2008).

Kang et al. (2003), Shin and Park (2008) define "digital storytelling" as storytelling that is conducted using digital technology as the medium or method of expression, in particular using digital media in a computer-network environment. Digital storytelling encompasses these key characteristics: Flexibility, universality, interactivity and community formation (Park & Seo, 2009). Flexibility in digital storytelling refers to the creation of a non-linear story using digital media technology (Gregori-Signes, 2008). Universality means that anyone can become the producer of digital stories, due to the wide availability of computers and easy-to-use software. Interactivity refers to the participation of users in the development of the stories using media characteristics that can be mutually exchanged.

Paul and Fiebich (2002) argue that digital stories can be presented in a variety of formats such as text web pages, a nonlinear interactive website, a digital song, a digital video (Chung, 2006), an online game, or a virtual reality world (Shin & Park, 2008). In particular, virtual reality learning environments have the potential to provide rich and engaging learning experiences for students that include investigation, discovery, and creation (Dickey, 2005; Park & Baek, 2009; Robin, 2008). Students experience 'learning by doing' while making a digital story. They perform multiple tasks within the virtual world as researchers, playwrights, designers, media producers, and educators (Chung, 2006).

Communication seems to be more effective when it occurs through digital storytelling. The student can experience storytelling activity in a virtual-reality learning environment such as Second Life. Second Life allows synchronous communication with others, using avatars to generate a sense of presence. Participants write their stories dynamically through interactive communication when they meet, visit the land, work, and talk to other residents of Second Life.

According to Robin (2007), writing is an essential part of the process of creating digital stories. Various research studies have verified the effectiveness of digital storytelling in improving students' writing skills (Ballast, Stephens, & Radcliffe, 2008; Gakhar & Thompson, 2007). It is, therefore, worth thinking about virtual worlds, which contain various multimedia components, as an ideal medium for digital storytelling. Creating digital stories in an immersive virtual location may attract and motivate people into writing unconsciously. Ultimately, digital storytelling may encourage people who don't like writing or who have no confidence in writing.

Over the past decades, a significant amount of research examined using video editing software (such as Windows Movie Maker) to create video clips for digital storytelling activity. However, in this study, we put more emphasis on the writing process and suggest performing digital storytelling in virtual worlds with open-ended, edutainment elements. The purpose of this study is to examine the effects of digital storytelling on writing self-efficacy and flow in the virtual reality learning environment such as Second Life virtual world.

Literature Review

Benefits and Procedures of Digital Storytelling in virtual worlds

Definitions of digital storytelling differ among researchers, but demonstrate several important similarities and main ideas. The definition from The Digital Storytelling Association (2002) describes digital storytelling as giving expression to old forms of storytelling in a modern way. People deliver their knowledge, values, and wisdom with stories. Emerging technologies make it possible to see such stories on the computer screen. According to Armstrong (2003), digital storytelling is the same as reading and writing stories. However, digital storytelling's defining feature in education is that it shares information through multimedia.

The University of Houston (2009) Instructional Technology Department conducts studies examining the educational uses of digital storytelling. They suggest the following procedures for digital storytelling: In the first stage, the storyteller defines the parameters of the story. The learner should select a topic for the digital story. Next, he should search for image resources for the story (pictures, drawings, photographs, maps, and/or charts), audio resources (music, speeches, interviews, and/or sound effects), and informational content (perhaps from web sites, word processed documents, or PowerPoint slides). When the student has gathered all of his resources, he should begin thinking about the purpose of the story. Is the purpose to inform, convince, provoke, or question?

In the second stage, the storyteller organizes and selects specific audio, images, text, and other content for the story. He should import the images and audio into Photo Story. In this stage, the storyteller can modify the number of images and image order, if necessary.

In the third stage, the storyteller creates, records, and finalizes the story. He should decide on the purpose and point of view of the story and write a script that will be used as narration. He can record the narration with a computer microphone and import the narration into Photo Story. Finally, the digital story is finalized by saving it as a Windows Media Video (.wmv) file.

In the fourth stage, the storyteller presents the story and receives feedback. He can show the story to his colleagues and gather feedback about how the story could be improved, expanded, and used in the classroom. If well received, he can teach colleagues how to create their own digital story.

Digital storytelling has the potential to facilitate teaching and learning in the classroom. Consequently, many of teachers intend to utilize the technology in classrooms at all levels of schools, from K-12 to higher education. Digital storytelling, when it is integrated into the classroom setting, can be a compelling teaching method to gain and hold students' attention. At the same time, it provides a creative and open-ended environment (Sadik, 2008). It is worth considering the application of digital storytelling in various subjects. When digital storytelling is integrated with

content areas and across the curriculum, it can be a way of expressing students' ideas and thoughts (Gakhar & Thompson, 2007; Lee, 2005; Shin & Park, 2008). This expression can promote learners' active participation and emphasize the active role of students rather than teachers. Therefore, it encourages student-centered learning. The following figure depicts how digital storytelling enhances the convergence of four student-centered learning strategies: student engagement, reflection for deep learning, project-based learning, and technology integration into the classroom (Barrett, 2006). These learning strategies can be facilitated through digital storytelling activities. All of the four strategies are attracting a great deal of attention from educators and teachers nowadays.



Figure 1. Convergence of student-centered learning strategies (Barrett, 2006)

Han (2007) contends that digital storytelling is a necessary element in producing edutainment learning contents. Edutainment is a core concept in creating learning contents in the 21st century. The word "edutainment" consists of "edu-" which is shortened from 'education', and "-tainment" which is shortened from 'entertainment'. Baek (2005) states that with the rapid development of computer technology and multimedia elements, edutainment can make learning much more attractive, potentially facilitating learning and eliciting students' active participation.

Students must master a wide variety of skills in order to accomplish the creation of a digital story, including narrative styling, written composition, visual literacy, media literacy, as well as an understanding of film conventions (Banaszewski, 2005). It is challenging for students to create their own digital stories and simultaneously acquire such skills. Although challenging, we can expect digital storytelling to foster such skills.

Research on digital storytelling continues. Sanchez (2009) asserts that the form of digital storytelling in Second Life is similar to general digital storytelling. The difference between them is the type of final products. The final products of general digital storytelling are video clips which are 2-5 minutes long. However, when it comes to Second Life, the artifacts are objects which are used to present the stories, giving texture to the objects.

In the research administered by Sanchez (2009), the students were asked to write a story, use tools in Second Life to make a digital story, and finally present their stories on the wall inside a condo in Second Life which was made by the researcher beforehand. The audience avatars walked through the condo, and the student who made the digital story gave a narration of his story. Sanchez asserts that digital storytelling is a way of self-expression. He points out that when students are making digital stories in Second Life, they can see each other's work. He proposes that this is a type of asynchronous social learning and modeling.

On May 17, 2008, the Center for Digital Storytelling and the New Media Consortium held a conference in Second Life about "Storytelling in Virtual Environments". Jen Friedberg, one of the speakers at the conference, said that storytelling in virtual worlds is beneficial. Accordingly, in virtual worlds, components of a story such as images and learning contents can be presented as realistic and vivid, almost similar to the real world. The users who see the digital story will have a strong sense of being there, so that will make it difficult to feel that they are using a computer. She suggests that it is advisable to properly utilize new powerful tools to present stories.

Kelleher and Pausch (2005) utilized a program called "Storytelling Alice" to inspire middle school girls' interest in programming. Storytelling Alice is a tool for creating 3D virtual world as a form of storytelling. Shin and Park (2008) conducted a study about digital storytelling in a virtual world, and verified the effect of digital storytelling type on learners' involvement and comprehension. Three scenarios of digital storytelling were performed: one where

the audience only listened, one where the audience listened and interacted, and finally one where the audience participated in constructing the environment of the story. The results showed that students were more engaged and enthusiastic in the third scenario. The study demonstrates that the realistic story environment of the 3D virtual world made a significant contribution to students' active engagement. Ibanez, Aylett, and Ruiz-Rodarte (2003) proposed storytelling in virtual environments from a virtual guide perspective. The guide navigates the virtual environment by storytelling.

Writing in Digital Storytelling

Although the ultimate purpose of digital storytelling is to tell the story to the audience, story writing is also important. A good script makes the digital story more effective and successful. Robin (2007) stresses story writing, describing how people usually spend more "digital" time searching for images and audio files rather than on the story itself. In contrast, he emphasizes that the process of selecting a meaningful topic and writing the story about the topic is the most important process in digital storytelling. When students pay more attention to the writing process, they will have ownership of their stories. Likewise, students will be motivated and engaged in the process of digital storytelling. In summary, although digital elements are important, writing should not be neglected, because it is an essential part of digital storytelling.

Gakhar and Thompson (2007) point out that digital storytelling provides students with opportunities to write creatively and organize thoughts in coherent ways, by designing and producing realistic artifacts. They also demonstrate that digital storytelling can improve students' writing skills, critical thinking skills, and media literacy.

Ballast, Stephens, and Radcliffe (2008) utilized digital storytelling as a means of improving students' writing. They examined the effects of digital storytelling on sixth grade students' writing and their attitudes toward writing. The experimental group was asked to craft a digital story with Photo Story. The control group was asked to convert a story which was written in advance into a word document, and then upload it to a class online magazine. At the end of the course, the researcher interviewed the students about the revisions they had made in the process of creating their digital stories. According to the interview data, the researchers found that the students in the experimental group were more engaged in digital storytelling and paid more attention in revising their writing compared to the control group who did not create digital story. The traditional writing group edited their writing merely by checking spelling and counting words. The digital storytelling group edited their stories more carefully by choosing appropriate words, adjusting the sequence of sentences, or removing sentences.

Warburton and Perez-Garcia (2009) reviewed multi user virtual environments, mainly Second Life. They examined the advantages of virtual environments and Second Life. First, virtual worlds can assist in visualizing and contextualizing objects we cannot see because of distance and monetary restrictions, or things which cannot be seen in real life situations. Second, there are a variety of interactions, including avatar-to-avatar interaction and avatar-to-object interaction. Third, the user is presented as an avatar, feeding the sense of really being in a virtual environment, unconscious of the mediation of the computer. Such feelings of immersion in virtual worlds enrich learners' experiences.

Digital storytelling gives expression to the ancient art of storytelling in a modern way. Multimedia components, such as images, sound, music, and others, are added to present the story. General digital storytelling is edited with software, such as Windows Movie Maker, Apple iMovie, and Adobe Premiere. However, the 3-D virtual world of Second Life maximizes the effects of multimedia, potentially employing components such as 3-D objects, images (snapshots), sounds, videos, and others. According to Sanchez (2009), in Second Life, digital storytelling follows the same premise as general digital storytelling. However, the key difference is that instead of creating a video, students create an experience or a space in which others can walk through their stories.

In spite of the educational potentials that virtual environments have, little research has been conducted about teaching writing in virtual environments, such as games and virtual worlds. In research conducted by Warren and Dondlinger (2008), a multi-user virtual environment named Anytown was used to support students' writing, on the basis of Problem-Based Learning. In Anytown, learners are required to take the role of cub reporters. A series of mysterious events were embedded in this MUVE including a burning building and strange lights emanating from the town's river. Learners should investigate these events in order to complete their writing tasks. The findings from this

research showed that learners acquired improvements in their writing performance in comparison to the traditional form of writing. Mayo (2004) developed a multi-player interactive game called Story world Builder, which was designed to motivate learners to write better. In this game, learners design and build a virtual place as the environment for their stories. They play active roles in the virtual environment as characters within the story. The program saves the transcript. The students write their stories using the transcript.

Research questions

This study aims to better understand the impact of digital storytelling on student learning, in particular when students actively engage in the storytelling process. The object is to find a meaningful difference in writing for digital storytelling on writing self-efficacy and flow between learners who use virtual reality learning environment and those who use Windows Movie Maker off-line.

Research Methods

Participants, settings and procedures

The target population for this study consisted of sixty-four undergraduate university students in South Korea. They were from two classes taking “Media Production for Teaching and Learning” at the Korean National University of Education. There were 32 students in each class. Their ages ranged from 20 to 22 years old. One class was selected to perform digital storytelling in the virtual world of Second Life, and the other class was selected to perform digital storytelling off-line utilizing the video editing software Windows Movie Maker.

In this study, participants were divided into two groups. One group performed digital storytelling off-line, utilizing Windows Movie Maker. Another group performed digital storytelling in Second Life. The off-line group followed the procedures of general digital storytelling suggested by the University of Houston. The activity for the Second Life group was designed by the author of this study. The procedures were as follows:

Step 1) Introduction to Second Life

Ask students to make an account of Second Life. Then, introduce the basic functions of Second Life, such as walking, flying, teleporting, communicating, object building. Also teach students how to search for freebie items, how to upload images, how to take snapshots, and how to buy items.

Step 2) Introduction to Digital Storytelling

Teach the definition and procedures (step 3 to step 7) of digital storytelling, and demonstrate an example of digital storytelling in Second Life.

Step 3) Story topic: Travelling through spaces and time

The topic of the story is travelling through spaces and time. They can create the story; it can be real or imaginary.

Step 4) Imagination of the story

The students do team work. A team consists of five to six students. Because there are 32 students in a class, four teams consist of five members, and the other two teams consist of six members. In this step, students travel through the places in Second Life that they like and capture photos of the places they plan to use in their story. They should get ideas from the places they visit in Second Life, and then gather ideas to compose a story.

Step 5) Writing the story

On the basis of step 4, students write down the story in a Word Processing file.

Step 6) Creating the environment of the story in Second Life

After writing the story, pick out the main sentences and add them into the images they captured. Then, build panels and upload the images to create the environment. Finally, arrange the panels in the sequential order, so that other Second Life residents can walk through the same path and see the story. Throughout this process, the learners should try to uncover some shortcomings in their writing, continuously going back to step 5 to modify their stories. Then they can create the environment again, according to the modified story. Repeat this process until the story is completed.

Step 7) Sharing stories

In this step, each team tells their story. One student should narrate. Other students should be the audience. Afterwards, they can give advice to each other.

Instruments

The primary tool used in this study was the virtual world called Second Life. Additionally, two kinds of tests were administered: first, the test of writing self-efficacy, and second, the test of flow state. Both of them included a pretest and a posttest. Each test was administered twice, before and after the experiment. Details about the tests are described below.

Second Life virtual learning environment for digital storytelling

Second Life is a 3D virtual world imagined and created by its residents. Since it was launched in 2003, Second Life has attracted attention from educators all over the world as an instructional technology platform (Park et al., 2008; Sanchez, 2009). Academic institutions from at least 14 countries are engaged in Second Life. The number of institutions is more than 150 (Foster, 2007). Recently, Second Life has been the most popular multi-user virtual environment used in education (Warburton & Perez-Garcia, 2009). Residents in Second life are presented as avatars. They can easily build, walk, fly, and teleport to anywhere they want to go in the virtual environment. There are also communication tools, like Instant Message, Local Chat, Note card, and Voice Chat. The functions integrated with its interface make it possible to build an environment in which digital storytelling can take place.

Test of Writing Self-Efficacy (Pre-post Test)

The writing self-efficacy questionnaire by Pajares and Valiante (2001) was used in this study. The questionnaire consists of 10 questions measured on a ten-point Likert scale. The total score of this test is 100 point. The reliability of this test is .88 (Cronbach's α). In this study, the questionnaire was modified and translated into Korean.

Table 1. Writing self-efficacy test

Content of Item	
1.	I can write down my opinion without wandering away from the subject.
2.	I can make the story that contains a subject have powerful impression.
3.	I can construct simple sentences using appropriate grammar.
4.	I can write a well organized and systemized article, which consists of introduction, main body, and conclusion.
5.	I can complete a sentence with a proper conclusion.
6.	I can appropriately use verbs, prepositions, adjectives, and so on.

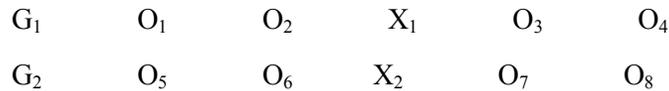
- | |
|--|
| 7. I can construct appropriate dialogue. |
| 8. I can use correct words to make a sentence |
| 9. I clearly know the place where should I place emphasis in a sentence. |
| 10. I can structuralize paragraphs, to verify the main idea of the topic sentence. |

Flow State Scale (Pre-post Test)

The flow scales are self-report instruments designed to assess the construct of flow, or optimal experience. The Flow State Scale was developed by Jackson and Eklund (2004). The scale was developed on the basis of Csikszentmihalyi (1990)'s flow theory. It contains of 36 items assessed on a five-point Likert scale. The reliability (Cronbach's α) of the test in this study is .95.

Research Design

A quasi-experimental analysis was carried out in two classes at Korea National University of Education, during 6 weeks in the second semester of the 2009 academic year. In this study, the activity of writing for digital storytelling was the independent variable. The dependent variables were writing self-efficacy and flow. There were two groups in this study. One group performed digital storytelling in Second Life, and another group created their digital stories off-line. Two-independent samples t-tests and multivariate analysis were used to compare the changes in writing self-efficacy between two groups, and also changes in flow score between two groups.



G₁ : Second Life Group / G₂ : Off-line Group
 O₁, O₅ : Writing Self-Efficacy Pre-test/O₂, O₆ : Flow State Pre-test
 X₁ : Writing for Digital Storytelling in Second Life / X₂ : Writing for Digital Storytelling Off-line
 O₃, O₇ : Writing Self-Efficacy Post-test / O₄, O₈ : Flow State Post-test

Results

The main purpose of this study was to examine the effects of writing for digital storytelling on writing self-efficacy and on flow in the virtual world of Second Life. In this study, one of the groups created their digital stories in Second Life, and the other group created their digital stories off-line with Windows Movie Maker. Before and after the activity of digital storytelling, students' writing self-efficacy and flow were measured using the tests mentioned above in the research methodology section. Two-independent sample *t*-tests and multivariate analysis were performed using the SPSS 17.0 statistics program. The changes in scores of writing self-efficacy between the two groups were compared, and the changes in scores of flow between the two groups were also compared. This test was found to be statistically significant. The following table summarizes the results of the two-independent samples *t*-tests and multivariate analysis.

Table 2. Results of two-independent samples t-tests

	Group	N	M	SD	t	p
Writing Self-Efficacy	Second Life Group	32	6.63	7.76	2.307	0.024*
	Off-line Group	32	2.50	6.49		
Flow	Second Life Group	32	3.67	.16	13.641	0.001***
	Off-line Group	32	3.07	.19		

* Correlation is significant at the 0.05 level. *** Correlation is significant at the 0.001 level.

As indicated in Table 2, the difference in the mean change score of writing self-efficacy between the two groups was significant, $t(62)=2.307$, $p<.05$. The mean change score of writing self-efficacy in the Second Life group ($M=6.63$, $SD=7.76$) was significantly higher than that of the off-line group ($M=2.50$, $SD=6.49$). The alpha level was .05. The total mean score of writing self-efficacy is 10 point. The mean change score has been improved 4.13 point. Namely, the activity of writing for digital storytelling was effective in improving students' writing self-efficacy.

The difference in the mean change scores of flow between the two groups was significant, $t(62)=13.641$, $p<.001$. The mean change scores of flow in the Second Life group ($M=3.67$, $SD=.16$) was higher than that of the off-line group ($M=3.07$, $SD=.19$). The alpha level was .001. The total mean score of flow is 5 points. The mean change score has been improved .60 point. It indicates that the activity of writing for digital storytelling in Second Life is effective in enhancing students' flow level. The experiment results demonstrate that digital storytelling in Second Life is more effective than digital storytelling off-line.

The flow scales assess 9 dimensions of flow. The scale consists of 9 sub-categories containing a total of 36 items. *From flow scale characteristic* there is a close correlation among sub-category variables of flow. We used multivariate analysis to verify the variations in flow level among sub-category variables. Results of the post-flow multivariate analysis of the relationship between the groups are displayed in Table 3. According to the result, there was significant difference between virtual reality learning group looks like Second Life and off-line with movie maker for digital storytelling ($\lambda=.003$, $p=.001$). In other words, the group that performed the digital storytelling activity in Second Life experienced a higher level of immersion than the group that did the digital storytelling activity with Windows Movie Maker.

Table 3. Results of multivariate analysis for flow (Wilks' $\lambda=.003^{***}$, $p<.001$)

Variance Sources		<i>M</i>	<i>SD</i>	<i>F</i>	<i>p</i>	η^2
Challenge-Skill Balance	Second Life(n=32)	3.69	.25	117.474***	.001	.655
	Movie Maker(n=32)	2.94	.30			
Merging of Action and Awareness	Second Life(n=32)	2.53	.12	72.145***	.001	.538
	Movie Maker(n=32)	2.03	.31			
Clear Goals	Second Life(n=32)	3.86	.16	46.721***	.001	.430
	Movie Maker(n=32)	3.50	.25			
Unambiguous Feedback	Second Life(n=32)	3.84	.20	119.370***	.001	.658
	Movie Maker(n=32)	3.23	.25			
Total Concentration	Second Life(n=32)	3.45	.27	4.740*	.033	.071
	Movie Maker(n=32)	3.30	.30			
Sense of Control	Second Life(n=32)	3.36	.16	18.036***	.001	.225
	Movie Maker(n=32)	3.48	.06			
Loss of Self-Consciousness	Second Life(n=32)	3.98	1.03	117.952***	.001	.655
	Movie Maker(n=32)	3.57	.38			
Time Transformation	Second Life(n=32)	4.33	.38	62.984***	.001	.504
	Movie Maker(n=32)	3.58	.38			
Autotelic Experience	Second Life(n=32)	3.94	.25	10.145**	.002	.141
	Movie Maker(n=32)	3.56	.62			

* Correlation is significant at the 0.05 level. ** Correlation is significant at the 0.01 level. *** Correlation is significant at the 0.001 level.

From the results of the Multivariate Analysis of Variance (MANOVA), among the nine categories of flow (challenge-skill balance, merging of action and awareness, clear goals, unambiguous feedback, total concentration, sense of control, loss of self-consciousness, time transformation, autotelic experience), a significant difference existed among digital storytelling groups (Wilks' $\lambda = .003$, $p<0.001$). Wilks' λ represents the part of within-group variation against total variation, where a Wilks' λ close to 0 means that differences between groups are major. According to η^2 , which represents the explanatory power of the independent variable, 66% of total change score can

be explained as the contribution of challenge-skill balance, 54% as the contribution of merging of action and awareness, 43% as the contribution of clear goals, 66% as the contribution of unambiguous feedback, 7% as the contribution of total concentration, 23% as the contribution of sense of control, 66% as the contribution of loss of self-consciousness, 50% as the contribution of time transformation, 14% as the contribution of autotelic experience. The main factors contributing to digital storytelling in virtual worlds are challenge-skill balance, unambiguous feedback, and loss of self-consciousness.

The virtual environment like Second Life can provide players balanced challenge and skill. This makes players motivated and engaged in the activity of digital storytelling. In virtual worlds, students can see their stories intuitively, in the whole process of creating digital stories. Thus, they can find problems in their stories, and make revisions more easily. This can be considered as a kind of intrinsic feedback. Learners are represented as avatars, and who participated in the digital storytelling activity is also the avatar. Avatar is the agents of students. Therefore, when students are totally involved in the activity in the virtual world, they can't even be conscious of themselves. All three elements are an important factor that leads to flow, in the activity of digital storytelling in virtual worlds.

Conclusion and Suggestions

Change increasingly defines the nature of storytelling in an information age. Storytelling is rapidly and continuously changing as new technologies for information and communication emerge and users craft new methods for employing these technologies. Moreover, these new technologies for information and communication permit the exchange of even newer technologies and visions for their use. This speeds up the already rapid pace of change in the forms and functions in virtual worlds, increasing the complexity of the challenges we face as we consider how to prepare students for their virtual reality environment.

Meaningful technological integration is defined as curricula utilizing authentic tasks that intentionally and actively help learners to construct their own meanings from thinking about experiences (Jonassen et al., 1999). Digital stories are a form of communication and as they are created, students apply critical thinking skills while selecting the appropriate media to convey the story's message to the audience. It provides the student with a learning environment to apply communication skills, work collaboratively, and think critically while addressing content and technology standards.

The purpose of this study was to examine the effects of writing for digital storytelling on writing self-efficacy and on *flow* in a virtual learning environment such as Second Life. Through statistical analysis, we can conclude that digital storytelling in Second Life is more effective than digital storytelling off-line. Writing self-efficacy and flow can be improved through actively engaging in writing for digital storytelling in a virtual-reality learning environment similar to Second Life.

The findings of this study have implications for teachers of writing. Digital storytelling can be used in classroom settings as a means of teaching writing. In the virtual world, students can visit virtual places using the teleporting function, without any constraint of time and space. It can stimulate their imaginations and encourage more creative writing. Then they can visualize the stories they imagine, by creating objects and changing the forms of those objects, thereby realistically enacting their stories. Through the visualization, they can see the structure of the whole story clearly. It will help them to identify and correct mistakes they have made, to construct a solid logical structure, and to rearrange their thinking in a logical way.

As virtual reality technology has advanced, it has been widely touted as a major advance that can offer meaningful support for educational purposes. There are several ways in which VR technology is expected to facilitate learning. One of its unique capabilities is the ability to provide students with the opportunity to learn in open-ended learning environments and to interact in ways that distance, time, or safety factors make unavailable. The type of activities supported by this capability allows for the prospect that students will be better able to master, retain, and share new knowledge as they actively engage in constructing knowledge in virtual learning environments. Jakes and Brennan (2005) propose that, in the future, digital storytelling can be a potent learning experience that encompasses much of what society hopes that students will know and be able to perform in the future classroom.

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