Usage Patterns and Effects of Mobile Learning Activities Using Social Learning Apps on the Achievement of Undergraduate Students in a History of Art Course

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Abstract

The main objective of the study was to identify the effect of mobile learning activities using social learning applications (apps) based on the principles of constructivist learning on students' learning achievement and behavioral patterns in a History of Art Course. Accordingly, two mobile apps, Pinterest and Piazza, were adopted in the present study. A one-group pretest and posttest experimental design was implemented to evaluate the effectiveness of the proposed approach. The participants were 57 female students studying in the second semester of the Computer Arts program of a public sector women university of Pakistan. The intervention spanned 6 weeks, and comprised four assignments given alternately on Pinterest and Piazza each week so that the students could use both tools at least twice. Student performances were measured using a pretest and posttest. The results revealed that there was a significant effect of using the social learning apps on the students' achievement in the History of Art Course. Low achievers gained significantly more than high achievers. The results suggest that well-designed activities using social learning apps need to be incorporated into the teaching of courses for undergraduate students.

Keywords

Social Learning, Pinterest, Piazza, Constructive Learning, History of Art, Mobile Learning, Smartphones.

Introduction

Mobile technology that includes cellphones, smartphones, tablets, and wearable devices (Bernackia et al., 2020; Mayer, 2020) is the earth's most widespread form of technology (Bernackia et al., 2020). In recent years, rapid development in mobile technology resulted in low costs with increasing capacity and capability (Sulisworo & Toifur, 2016). Ownership of personal smartphones and tablets is rising rapidly and it has decreased the ownership of desktop and laptop computers (Anderson, 2015). Internet penetration has been increasing over time (Lissitsa & Chachashvili-Bolotin, 2016), with a total of 63.2% of the world population being internet users on October 20, 2020 (Miniwatts Marketing Group, 2021a). Smartphones and tablets are the most preferred choices for internet access and communication due to their portability and convenience (Ray & Saeed, 2015).

Information Communication Technology (ICTs) and the Internet have influenced and improved every system of life including education systems across the world (Uygarer & Uzunboylu, 2017; Lissitsa & Chachashvili-Bolotin, 2016). The Internet has enhanced the facilities and types of teaching materials, and has provided more choices and greater flexibility in the process of teaching and learning (Uygarer & Uzunboylu, 2017). E-learning, the teaching and learning through computers and the Internet, is a means of lifelong learning and the requirement of both society and educational institutions (Umek et al., 2015). In the future, the role of e-learning will be more important than traditional and blended learning (Baris, 2015). Educators (Pal et al., 2013) and educational systems are required to use ICTs to improve the level of teaching and learning (Uygarer & Uzunboylu, 2017; Wang et al., 2014). The rapid proliferation of mobile technologies has led to the interesting research area of mobile learning, which refers to learning in multiple contexts and includes content and social interactions through the use of personal mobile devices (Crompton, 2013). Mobile technology plays a positive role in promoting students' motivation (Mayer, 2020). It has been

widely used for teaching and learning as it allows closer interaction between students, and offers authentic environments (Hwang & Chang, 2020).

O'Reilly (2007) first explained Web 2.0 as a shift from one-way broadcast-oriented Web 1.0 that transmits from the website owner to an audience like mass media, to the second-generation Web that is a rich platform for applications and services for the interaction, collaboration, information sharing, and creation of web content by groups of people. Web 2.0 includes various Web developments for its key concepts such as collaboration, user participation, file sharing and social networking (Chiang et al., 2009). Web 2.0 changed the role of the user from a passive receiver to an active user who creates content. Hosted services and Web-based communities such as social-networking sites (e.g., Facebook, MySpace), video sharing sites (e.g., YouTube), wikis, and blogs, are aspects of Web 2.0 (Stern, n. d.).

History of Art is a field of humanities that is related with various disciplines including history, philosophy, and the visual arts. It is about visual literacy, history and the aesthetics of photography, critical analysis of art works, interpretative skills and technological abilities related to visual communication, evolution of culture through artistic productions such as paintings, sculptures, architecture, and the graphic and decorative arts, methodologies, critical theory, analysis of contemporary issues in the practice and display of art, art and architecture of different periods and civilizations, and contemporary artistic movements (Study portals, 2020).

The teaching of history of art has undergone changes during the last decade. Now art historians are increasingly using computer-based tools (Donahue-Wallace et al., 2008). The use of such tools and of the Internet to teach the history of art is feasible in Pakistan where the Internet penetration has been gradually increasing, from 133,900 in 2000 to 34,342,400 in 2016, and 71,608,065 in June 2019 (0.1%, 17.8%, and 32.4% of the population respectively) (Miniwatts Marketing Group, 2021b). Research in the area of instructional technology covers mostly Web 1.0 tools (Davis, 2012).

The current study uses the social learning apps, Pinterest and Piazza, in mobile learning activities of a History of Art course and explores the effect of the mobile learning approach on the students' achievement. Moreover, the study explores how the usage patterns of the social learning apps and the achievement gains of the students are related with each other.

Literature Review

Web 2.0 and Learning Theories

There is a tremendous development in the field of ICT since the start of 21st century (Ray & Saeed, 2015). Rapid dissemination of information and technological advancement changed the knowledge and skills expected from the students and possibilities in teaching methods suitable for students' learning styles. The Internet has eliminated the constraints of space and time in traditional teaching and learning in such a way that it has become a milestone, as in "before and after internet" (Usal & Şirin, 2015).

Web 2.0 tools engage the user in interactive activities (Davis, 2012). The rationale for using Web 2.0 technology in education is that it supports a paradigm shift from teacher-centered to student-centered pedagogies. The engagement, motivation, communication, and assessment it offers are necessary for desirable learning experiences, and offer interactivity inside and outside the classroom for today's Digital Native students (Buqawa, 2015). It extends and shifts the learning from traditional to collaborative, and facilitates active participation, ownership, greater control over information flow, the personalized needs of students, and interactivity for knowledge sharing, conversations, and exchange of experiences, thus dynamically enriching personalized information and knowledge generation (Anshari et al., 2015). The asynchronous interaction that it offers (AlJeraisy et al., 2015) is helpful when participants have to reflect on complex issues, and critically assess their peers' ideas (Harastinski, 2008). It is therefore a necessity today to integrate Web 2.0 technology into education and to use it as a tool to support teaching (Dede, 2007), develop curricula and digital educational and learning resources, and to offer students the opportunity to build their knowledge in inclusive and global ways in new types of learning environments (Paiva et al., 2008).

There is an old debate about the nature of teaching and learning and the acquisition of knowledge by learners. Constructivists such as David Ausubel, Jean Piaget, and Lev Vygotsky (Cakir, 2008) believe that knowledge is constructed by an individual through active thinking which comprises selective attention, organization of information, and integration with or replacement of existing knowledge. Hence, individuals need to be both behaviorally and mentally engaged in the learning process. Another important aspect is social interaction through which shared meaning is created (Cakir, 2008; Mayer, 2004). The social aspect of learning was introduced by Vygotsky (1935). A person covers the distance from "the zone of the actual" to the "zone of proximal development" by learning from more knowledgeable and competent persons through dialogue and collaboration in groups or in an authentic social context. Bruner (1973) sees learning as a socially productive and influential process in which

learners construct their concepts and ideas on the basis of their current and past knowledge and skills. Constructivist teaching has more positive effects on academic achievement than traditional lectures (Kim, 2005).

Garrison et al. (2000) introduced collaborative constructivism as a new paradigm in response to the new realities. It suggests that individuals learn from each other by sharing experience and knowledge by means of collaborative activities. Web 1.0 technologies catered to the transmission model of education, but the user-centered Web 2.0 supports the pedagogy of social and collaborative constructivism (Thomas, 2009). While posting, commenting, answering, and communicating with their peers and instructors through participatory and collaborative activities of Web 2.0 technologies, students negotiate the meaning and co-construct the knowledge among themselves according to the principles of social constructivism (Buqawa, 2015). The features of Web 2.0 technologies support interactive and constructive perspectives of learning. Web 2.0 makes the learning meaningful and goal-oriented by providing opportunities for immediate interactions with experts and peers and to reflect upon their own and others' experiences in an authentic learning context. Hence, a symbiosis is built between Web 2.0 technologies and social constructivist pedagogical models (Peytcheva-Forsyth, 2014).

Communal constructivism is an approach to learning in which students construct their own knowledge (Constructivism) as a result of experiences and interaction with their environment (Social Constructivism). They also contribute this knowledge to a communal knowledge base for the benefit of other learners, and hence contribute to the process of constructing the knowledge of their learning community (Holmes et al., 2001). Intertwining and symbiosis between the developments of learning theories and technologies resulted in communal constructivism. Web 2.0 technologies ensure communication and co-creativity between many to many users (Peytcheva-Forsyth, 2014) and offer innovative ICT-rich learning environments that allow new pedagogical practices of communal constructivism like the building of different forms of virtual and real communities, and different ways in which knowledge is constructed, published, shared, reconstructed, and republished by teachers as well as learners (Leask & Younie, 2001).

Learning knowledge is the process of connecting information sources or specialized nodes, and relies on a diversity of opinions (Siemens, 2005) according to connectivist learning theory. Web 2.0 technologies also support the connectivist theory of learning by providing the student with the tools to get more information, different opinions, comments, posts, links and

feedback for their learning. They also provide the students with an opportunity to connect with their teacher and peers (network of specialized nodes) for the enhancement of their learning.

Mobile Learning (M-Learning) and Ubiquitous Learning (U-Learning)

Much research has been conducted on collaborative mobile learning reflecting the strong connection between mobile technology and collaborative learning activities (Fu et al., 2018) as it offers opportunities for real-time learning and discussions with peers (Liu et al., 2008). Mobile technology is shifting learning environment and the role of teachers, students and schools. It facilitates personalized learning and cooperative learning design. Teachers should choose and use this technology for students learning success (Sulisworo & Toifur, 2016). Learners' performance is found to be improved in science, social science, and outside the classroom natural scenarios through collaborative mobile learning (Fu et al., 2018).

M-learning and u-learning are the models of e-learning for the development of knowledge, skills, and attitudes through wireless technologies (Zare & Sarikhani, 2016). U-learning is an emerging paradigm of e-learning having new educational practices for knowledge and skill development. It combines sensor technologies with mobile devices (Liu et al., 2016). The use of fixed and mobile computing devices and the Internet over the last 2 decades (Northey et al., 2018) has created the possibility of “here and now” (H&N) learning that occurs without the boundaries of place and time (Martin & Ertzberger, 2013). The u-learning system include multiple inputs, well-structured and rigorous learning materials, the coherent arrangement of tasks, a record of the learning process, and interaction with the environment. It is appropriate for learner-centered education as learners are more self-directed in this context, receive instant authentic information required for tasked-based and collaborative learning strategies, and receive adaptive feedback according to their personal needs. Authentic environment is obtained through sensor technology and wireless internet.

Self-regulated learners pursue their own personal learning goals based on their accumulated knowledge. The multiple inputs and interactions with the authentic environment help learners to connect their sensory memory to their long-term memory. Learning effectiveness in u-learning system is obtained in two steps: the external input from u-learning and the internal learning frame for learners. In the first step, personalized learning features with context variables and strategy-driven learning with process variable act as the external input for learners. The second phase comprises three components: learners retrieve information from their memory, are able to obtain more learning achievements, and feel greater learning motivation in u-learning (Liu et al., 2016). The development of wireless communications and sensor technology has shifted the research from e-learning to m-learning and then, it will be shifted from m-learning to u-learning (Zare & Sarikhani 2012).

Social Media and Education in the Mobile Era

The use of social media has rapidly increased during the last few years among students as well as working people (Raut & Patil, 2016). Billions of people are using social networking websites now a days and generating huge amount of data every hour. Social media engages the users with the internet more than any other application such as e-mail, games, videos, etc. (Ray & Saeed, 2015). Social Networking technology was not originally developed for instructional purposes (Adenubi et al., 2013). However, there is a need to employ social media technologies in education, particularly in higher education. Discussion forums, content communities, web blogs, and wikis engage teachers and students in exploratory learning by allowing them to create, review and share multimedia contents with each other. Learners have all time access to teaching material in a student-centered environment, without any unnecessary restrictions on the length of the content (Ray & Saeed, 2015). Online discussion boards may be used in fully online, hybrid, and traditional courses and synchronous and asynchronous discussions on online platforms are useful for students

(Blackmon, 2012). Dunn (2013) conducted a study with closed Facebook group and reported that majority of the college students found the learning through social media interesting and useful.

Bijari et al. (2013) found a negative relation between the use of social networking sites and the GPA of medical students. This could be due to the fact that chatting too much via these media reduced their learning time. Some previous studies have reported that teenage students are likely to become addicted to social media usage, and their academic achievements could be affected (Bijari et al., 2013; Raut & Patil, 2016). On the other hand, Prakash and Pankaj (2015) found a significantly positive relationship between the use of social media and the academic achievement of graduate and post graduate teacher trainees. Hence, it is recommended that social media should be used for educational purposes with proper learning designs so as to create a balance between social media usage and academic achievements (Tete & Abe, 2017).

Well-designed activities on online discussion boards have led towards the inclusion and development of pedagogical competencies, such as students' activities, acute thinking, motivation, collaboration, reflection, and other social constructivist attributes of the learning process. Thought provoking questioning helps develop students' critical thinking skills and improves their involvement in discussion boards (AlJeraisy et al., 2015) as well as making them feel that they are part of a learning community (Harris & Sandor, 2007). When deliberately used in education, various studies have found a positive effect of Web 2.0 on academic achievement. Web 2.0 technologies increased student engagement, research skills and the comprehension of scientific concepts of middle school science students (Chimo, 2012). Use of Web 2.0 significantly enhanced college students' knowledge, understanding, and communicative abilities in language (Malhiwsky, 2010). AlJeraisy et al. (2015) found in a 6-week experiment with university students that there was a positive impact of the online discussion board, Moodle, on students' grades and satisfaction. However, Davis (2012) provided technological instruction, including Web 2.0 technologies in math and science, to

fifth-grade students, but did not find an increase in their academic achievement compared with those students who received whiteboard and lecture instruction.

Objectives and Research Questions of the Present Study

The main objective of the current study is to explore the effect of mobile learning activities on the social learning apps, Pinterest and Piazza, on the achievement of undergraduate students in a History of Art course. Moreover, the study explored how the usage patterns of the Pinterest and Piazza tools and the achievement gains of the students are related with each other. Accordingly, an experiment was conducted to answer the following research questions:

1. How do the activities on Pinterest and Piazza affect the achievement of the undergraduate students in the History of Art course?
2. What are the contribution patterns of low, medium, and high achievers using the Pinterest and Piazza tools?
3. What are the patterns of achievement gains of the low, medium and high contributors on Pinterest and Piazza?

The current study incorporates seven principles of good practice in undergraduate education as suggested by Chickering and Gamson (1987): Contact between students and faculty through Web 2.0 technologies, communication and reciprocity among students, engagement and active learning, prompt feedback, time on task, communication of high expectations, and respect for diverse talents and ways of learning.

Methodology

Design of the Study

A one-group pre-test post-test experimental design was used in the present study. The pre-test and post-test were devised by the researcher with the help of the instructor to assess the achievement of students before and after the intervention.

Participants

The participants were the 57 female undergraduate students enrolled in the second semester of a Bachelors of Computer Arts program at a public university. The program included three levels of History of Art corresponding to each semester as an area of study. The participants were at the second level of this course. The intervention was offered in the History of Art course by offering activities using Web 2.0 technologies while still being part of a face-

to-face classroom. The participants had fair knowledge of using different software and web apps as they were the students of a computer-related program. Moreover, the majority of the participants had a background in Computer Science and Fine Arts at the intermediate level. The majority of the participants were of age 19 or older. Almost all of the students spoke Urdu and English. The lecture method along with PowerPoint slides was used in their regular classes.

Orientation

Before the intervention, a 2-hour orientation session on Web 2.0 tools and technologies was conducted. The session included presentation, demonstration, and answers to participants' questions and queries about the intervention and technologies. The aim of the study, the timeline for the intervention, information and links to tutorials, and how to use Pinterest and Piazza were explained to them. Tutorials were provided on YouTube by the researcher for the Pinterest and Piazza tools. In addition to using Pinterest and Piazza, the students used Gmail to ask for help and receive feedback, and YouTube to watch tutorials.

Instrument

A pre-test of 15 minutes was administered to all 57 participants after the orientation. The pre-test comprised 25 multiple-choice questions, each with four alternatives, to assess the students' knowledge before the treatment about the history of film, animation and photography. The participants were in the second semester studying the second level of History of Art. They were also studying courses related to Graphic Design and Photography. Therefore, they had some previous knowledge of the topic.

The post-test was a 25-item multiple-choice test to identify the students' performance after the intervention. Each item had four alternatives. The type, difficulty and distribution of questions of the post-test were similar to those of the pre-test. They differed only in the sequence of the questions and in the wording. The 15-minute post-test was administered to all 57 participants at the end of the intervention.

Intervention

Four online activities using the Web 2.0 tools, Pinterest and Piazza, and integrating the constructivist learning approach were used as the intervention. Each online tool was used for two assignments. The two Pinterest assignments were group assignments, and the two Piazza assignments were individual assignments, and they were given in alternating order. The activities created for Pinterest and Piazza were taken from MoMA's website, and were modified according to the tool and number of students. These assignments were explained to the students in the class and were completed after the class.

The intervention span was 4 weeks. Activities were assigned to the students each Tuesday, they had to submit them on Friday, and their results were announced on Monday. The schedule remained the same except for assignment 4 for which extra time was given as the students found it interesting and it took longer to finish it. Assignment 4 was submitted on the Friday of week 6. The teacher conducted a quiz using Piazza on the Tuesday of week 5 that was not actually designed as a part of the intervention. Thus, the intervention was extended by 2 weeks and so became a 6-week intervention.

Pinterest (www.pinterest.com) Visual Social Network. Twelve collaborative group boards were made using Pinterest, along with one classroom board. Rules, assignments marks, expectations, deadlines and resourceful videos were shared with the class on the online classroom board. With the help of the researcher, the teacher invited the leader of each group to their respective collaborative boards and they then invited their group members to the boards. Two assignments for Pinterest were further divided into three sub-assignments; every four groups had the same assignment. Students were able to see the boards of other groups that had the same assignments and could give their opinions or feedback in comments and connect with each other. The teacher provided prompt feedback to students that helped them to participate actively.

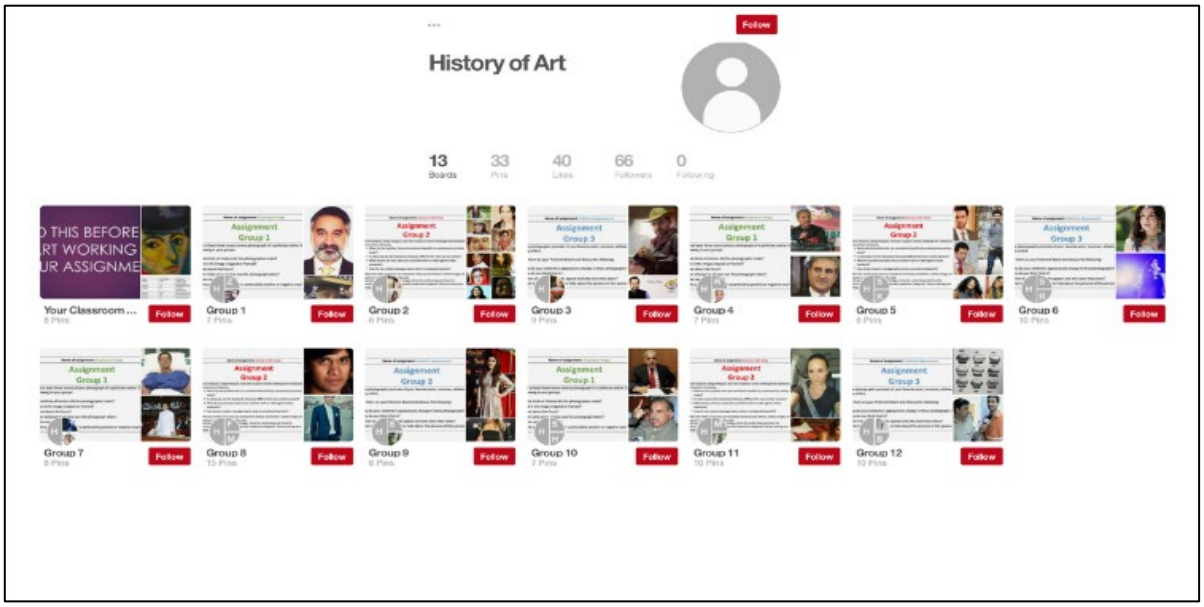
In version 1 of the week 1 assignment, the participants were asked to capture and share on their Pinterest board the two different views (photographs) of visually interesting areas in their neighborhood, highlighting those parts that have transformed and those parts that have remained the same since they have been there, and to reflect on the differences in context and how their neighborhood has changed. In version 2 of the week 1 assignment, the participants were asked to recreate the experience of posing for an early photographic portrait by sitting still for one minute, so some of their group members took photos of themselves at the start and end of that time, shared both photographs on their Pinterest boards and reflected on the difference between the photos in terms of time and what facial expressions and body language convey. In version 3 of the week 1 assignment, the participants were asked to share a posed and an un-posed photograph of themselves and reflect on how they were similar and different.

Version 1 of the week 3 assignment, “Beauty is Skin Deep,” required each group to collect six images of beauty, three conforming to contemporary beauty standards and three nonconforming, label the respective category of each image, and reflect on the beauty standards among the group. In version 2 of the week 3 assignment, “Shaping an image,” the participants were asked to pick out at least three recent photos of a politician online and discuss the choices made by the photographer while taking photos, cropping or framing the images, the focus of

the images, the point of view from which the photograph was taken, the importance of the caption, and the positive or negative way in which the politician is portrayed. Version 3 of the week 3 assignment, “Celebrity Appearances,” required the participants to find five photographic portraits of their favorite actor, musician, athlete, or other celebrity online, upload them on their Pinterest Board, and discuss how and why the appearance of the celebrity changes in these photographs with time, where and why these photographs were taken, and what images reveal or hide about the persona of this person. Screenshots of the Classroom board along with 12 group boards on Pinterest are shown in Figure 1.

Figure 1

Pinterest classroom board with 12 groups

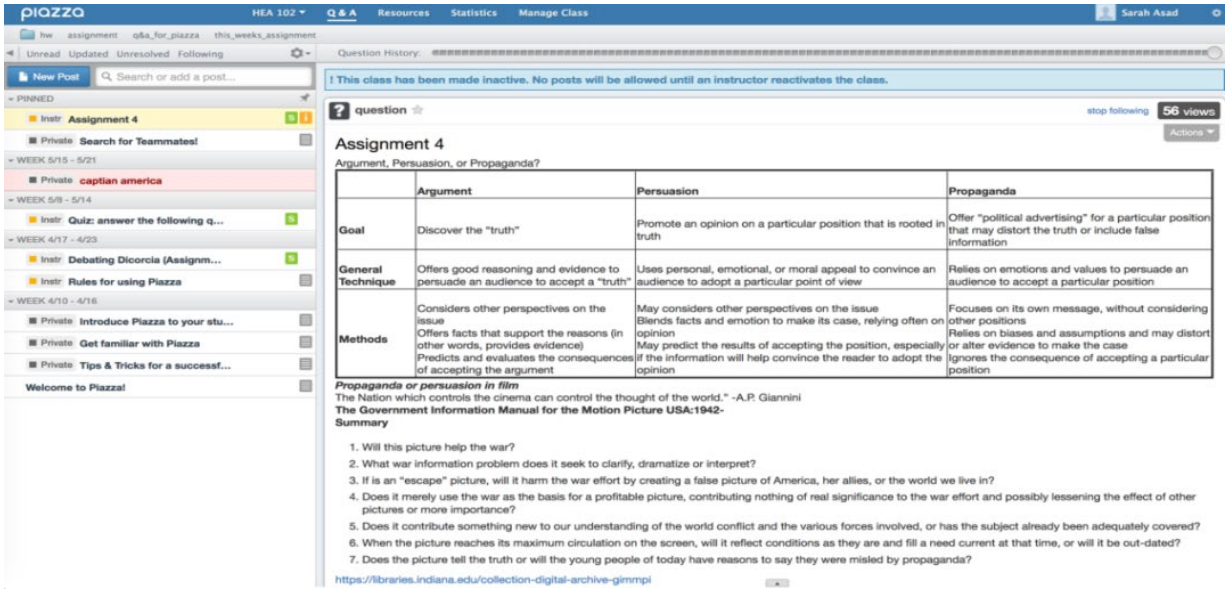


Piazza (www.piazza.com) Online Q & A platform. Piazza offers a perfect environment for art students, who thrive from discussions and criticisms of their work because they can seek and offer help as and when they need it through discussion on it. Piazza was used for announcements, course communication, question answers, discussions on topics, and knowledge sharing. Rules, tips and tricks were shared on Piazza for students. Three folders, one for “Assignments,” the second for "Q & A for Piazza,” and the third for “This week’s Assignment” were made for the ease of use of both students and instructors. Three tutorials were provided on YouTube for Piazza to assist the students when they encountered any problems while using this social learning app. The whole class participated individually in the Piazza assignments. The Week 2 assignment on Piazza, “Debating diCorcia,” required the

participants to read the article on the diCorcia Heads series legal battle from the link provided to them and to discuss whether they support Philip-Lorca diCorcia or Erno Nussenzweig, and to articulate their ideas about the legality, ethics, and artistic license of this case and the right to take, sell, and display photographs taken without the knowledge of the subject. In the week 4 assignment, "Propaganda or persuasion in film; The Government Information Manual for the Motion Picture USA:1942-," the students were asked to watch two major superhero movie franchises, one that is technically not "propaganda" films, giving their hero's point of view starting from the Second World War, and another that talks about World War II from the point of view of the Allied forces (American or British), and reflect in one to two paragraphs if these films shape their understanding of World War II, whether they present arguments, persuasions or propaganda, and if this was a nation building exercise or propaganda, where Captain America and X-Men First Class would be placed. They also needed to explain their stance on the regulations placed on the industry during war in 1942, and reflect on whether it was good to create such rules during war. A snapshot of Piazza assignment 4 is given in Figure 2.

Figure 2

Assignment 4 details on Piazza for students



Findings

Learning Achievement Gains

In order to identify the effect of the activities on the social learning apps, Pinterest and Piazza, on the achievement of the undergraduate students in the History of Art course, a paired

sample *t* test was administered on the pre- and post-test scores. The results are presented in Table 1.

Table 1
Paired sample t-test on the students' pre- and post-test scores

	N	M	SD	Mean difference	df	t
Pretest	57	19.23	4.69			
Posttest	57	29.81	6.39	10.58	56	-11.83***

Table 1 shows that the students' achievement scores significantly increased from the pre-test (M = 19.23, SD = 4.69) to the post-test (M = 29.81, SD = 6.39, $t(56) = -11.827$, $p < .001$). However, a control group was not available for comparison. It is suggested that in the future, such studies should be conducted with a true experimental design where a control group is also available for comparison so that conclusive findings can be achieved.

Contribution Level on Pinterest and Piazza of Low, Medium and High Achievers

All 57 students were divided into three equal groups (n = 19) of low, medium and high achievers on the basis of their pre-test scores, and their contribution frequency on Pinterest, Piazza, and their combined contribution were explored. ANOVA was applied to identify if the contribution frequency on Pinterest, Piazza, or the combined contribution of the low, medium and high achievers differed. It was revealed that the low, medium, and high achievers were not significantly different from each other with respect to contribution on Pinterest, F (2, 54) = 1.853, p = .167, Piazza, F (2, 54) = 3.109, p = .053), and combined contribution F (2, 54) = 3.070, p = .055. However, a non-significant pattern was identified, namely that the medium achievers contributed the most frequently on Pinterest (M = 33.37, SD = 21.36), Piazza (M = 38.16, SD = 44.93), and combined contribution (M = 71.53, SD = 63.04) compared with the contribution levels of the high achievers (M = 25.26, SD = 18.81; M = 30.68, SD = 32.87; and M = 55.95, SD = 43.14) and low achievers (M = 22.05, SD = 15.37; M 12.42, = SD = 10.74, and M = 34.47, SD = 24.31) as evident from Table 2 and Figure 3.

Table 2

Contribution level of low, medium, and high achievers

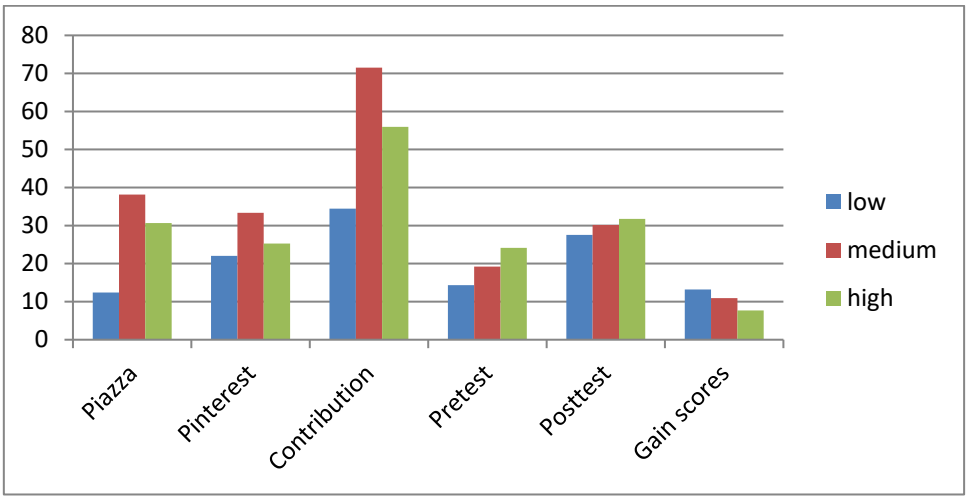
	Low achievers		Medium achievers		High achievers	
	M	SD	M	SD	M	SD
Pinterest contribution	22.05	15.37	**33.37**	21.36	25.26	18.81
Piazza contribution	12.42	10.74	**38.16**	44.93	30.68	32.87

Overall contribution	34.47	24.31	**71.53**	63.04	55.95	43.14
Pre-test	14.32	3.16	19.21	1.08	24.16	2.46
Post-test	27.53	6.03	30.16	6.78	31.74	5.92
Gain scores	**13.21**	6.25	10.95	6.75	**7.58**	6.35

One important finding was that the low achievers gained (M = 13.21, SD = 6.25) significantly higher than the high achievers (M = 7.58, SD = 6.35), F (2, 54) = 3.664, $p < 0.05$. This finding can also be seen in Table 2 and Figure 3.

Figure 3

Contribution and gain scores of the low, medium, and high achievers



Gain Scores of the Low, Medium, and High Contributors on the Social Learning Apps

The participants were divided into three equal groups on the basis of their contribution on Pinterest, Piazza, and their combined contribution, and the effect of their contribution on the gain scores of the students was explored. It was found that the gain scores of low, medium, and high Pinterest, Piazza, and combined contributors were not significantly different from each other as revealed by ANOVA (F (2, 54) = 1.971, p = .149; F (2, 54) = 1.880, p = .163; and F (2, 54) = 2.510, p = .091).

Table 3

Achievement scores of high, medium, and low contributors

Contribution	Range	Mean contribution	Pre-test	Post-test	Gain scores
Combined					

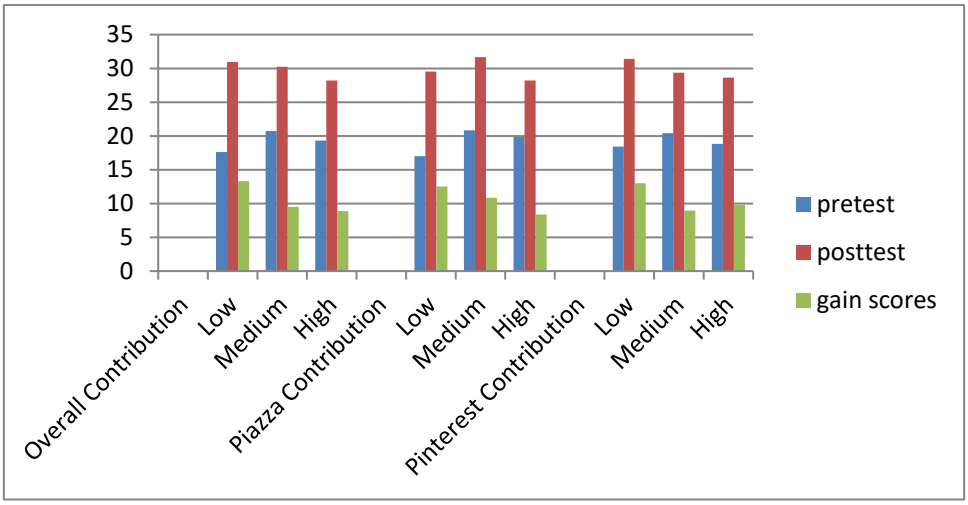
Low	9-30	19	17.63	30.95	**13.32**
Medium	31-53	41	**20.74**	30.26	9.53
High	55-275	101.95	19.32	28.21	8.89
Pinterest					
Low	2-15	10.42	18.42	31.42	**13**
Medium	15-29	21.47	**20.42**	29.37	8.95
High	29-84	48.79	18.84	28.63	9.79
Piazza					
Low	1-12	6.05	17	29.53	**12.53**
Medium	12-27	17.53	**20.84**	31.68	10.84
High	28-198	57.68	19.84	28.21	8.37

Descriptive statistics revealed a pattern that moderate combined, Pinterest, and Piazza contributors were the high achievers (M = 20.74, M = 20.42, M = 20.84). However, these patterns were non-significant except for Piazza where the pre-test scores of the medium Piazza contributors (M = 20.84) were significantly better than those of the low Piazza contributors (M = 17), F (2, 54) = 3.778, p <0.05.

Another non-significant pattern identified was that the low combined, Pinterest, and Piazza contributors gained more (M = 13.32, M = 13, and M = 12.53) than the medium (M = 9.53, M = 8.95, and M = 10.84) and high contributors (M = 8.89, M = 9.79, and M = 8.37) as evident from Table 3 and Figure 4.

Figure 4

Scores of low, medium, and high contributors



Discussion

Results of the study revealed that the activities on the social learning apps, Pinterest and Piazza, that engaged the participants in collaborative sharing and discussions in a constructivist environment had a significantly positive effect on the achievement of the students in the History of Art course. However, one limitation of the study is that it does not have a control group for comparison. It is suggested that future research should be conducted with a true experimental design so that there should be a control group for comparison. Davis (2012) did not find the effect of Web 2.0 technological instruction on the academic achievement of fifth-grade students in math and science. However, the findings of the present study are in line with the findings of Chimo (2012), who found positive effects of Web 2.0 technologies on the engagement, research skills and comprehension of scientific concepts of middle school science students; with AlJeraisy et al. (2015), who found a positive impact of the online discussion board Moodle on university students' grades and satisfaction in a 6-week experiment; and with Malhiwsky (2010), who found a significant effect of a Web 2.0 course on student knowledge, understanding, and communicative abilities in language.

The low achievers in the present study gained significantly more than the high achievers. The reason may be that the high achievers had less room for improvement, or it may be that the Pinterest and Piazza discussion boards were more effective for enhancing the achievement of low achievers compared with that of the high achievers.

Low, medium, and high achievers were not significantly different from each other with respect to combined contribution, Pinterest contribution, and Piazza contribution. Similarly, the gain scores of low, medium, and high combined, Pinterest, and Piazza contributors were not significantly different from each other. Some non-significant patterns were identified. First, the contribution of medium achievers (based on the pre-test) was the highest with respect to contribution on Piazza, Pinterest, and combined contribution compared with the contributions of high achievers and low achievers. Secondly, the moderate combined contributors, Pinterest contributors, and Piazza contributors were the high achievers (based on the pre-test). Thirdly, low Pinterest, Piazza, and combined contributors gained more than the medium and high contributors.

Adenubi et al. (2013) found a significantly positive correlation between academic achievement of university students and usage of social networking sites in a group which spent 2 hours on social networking sites but not in a group which spent less than 2 hours on social networking sites. AlJeraisy et al. (2015) found a significantly positive correlation

between number of clicks on the online discussion board Moodle and grades. Xia et al. (2013) found a significant positive relationship between number of postings on discussion forum Blackboard and results of the students and between the role of students in discussion as defined by the quality of postings and their results. The findings of the present study were not consistent with these findings. For high contributors, these discussion boards may be less effective due to the reasons that too many posts might be non-deliberate and time consuming (AlJeraisy et al., 2015) as constantly checking social media updates may negatively affect other valued activities such as concentrating on studies. Balancing the amount of time spent on social networking sites may be the key to success for controlling the negative aspects (Raut & Patil, 2016) and attaining maximum output.

Conclusion

The present study revealed that the activities on the social learning apps, Pinterest and Piazza, significantly improved the achievement of students from the pre-test to the post-test in the History of Art course, although the absence of a control group does not allow this finding to be a stronger one. However, the study reveals some interesting patterns regarding the contribution frequency and gain scores in achievement. The low achievers gained significantly more than the high achievers.

Low, medium, and high achievers (based on the pre-test) were not significantly different from each other with respect to combined contribution, Pinterest contribution, and Piazza contribution. Similarly, the gain scores of low, medium, and high combined, Pinterest, and Piazza contributors were not significantly different from each other. However, three non-significant patterns were identified. First, medium achievers (based on the pre-test) have the highest contribution frequency on Piazza, Pinterest, and combined contribution. Secondly, the high achievers (based on the pre-test) have moderate combined, Pinterest, and Piazza contribution frequency. Lastly, students with low Pinterest, Piazza, and combined contribution frequency have the highest gains in achievement.

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