PEOPLE: International Journal of Social Sciences
ISSN 2454-5899

Somaratne et al., 2019

Volume 5 Issue 3, pp.552-564

Date of Publication: 28th December 2019

DOI- https://doi.org/10.20319/pijss.2019.53.552564

This paper can be cited as: Somaratne, P., Ortega, M. G., & Falconer, L., (2019). Using 3D Virtual Activities to Conduct Collaborative Work. PEOPLE: International Journal of Social Sciences, 5(3), 552-564.

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USING 3D VIRTUAL ACTIVITIES TO CONDUCT COLLABORATIVE WORK

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Abstract

Collaborative work can be conducted either in a classroom environment or in a computer-supported environment. The virtual world is one such computer supported environment that is used to conduct group activities. In this study, we explore students' experiences in 3D virtual group activities. We conducted this study with the first-year Information Technology students in a Sri Lankan higher education institute. We planned this study in two steps; in the first step, we explored students' experiences in classroom collaboration. After that, in the second step, we explored students' experiences in virtual collaboration. Finally, we compared the results gathered from the questionnaire and found that students had a positive attitude about virtual collaboration compared to classroom collaboration. Moreover, we analysed the interview data qualitatively and identified students' views about classroom group work and virtual group work. After analysing the data, we identified that students prefer to work in virtual group work than classroom group work. Also, it was clear that students' participation and active engagement in

virtual group activities were higher than classroom group activities. Based on these findings, we conclude that students had a positive experience in virtual group work.

Keywords

Virtual World, Collaboration, Group Work, Virtual Activity, Higher Education, Sri Lanka

1. Introduction

Social constructivism theory expresses that interactions can be created through negotiations, discussions, and collaborations (Ernest, 2010; Ruey, 2010). In a learning environment, social constructivism is supportive in developing interactions between the teacher and student and among each student. Hence, social constructivism is an opportunity that assists students and teachers in sharing knowledge. That is, experienced and more knowledgeable learners or teachers can disseminate their knowledge, skills, and experiences to other inexperienced learners (Huang, 2002). As Ruey (2010) says, an individual can acquire knowledge through interactions and think independently through socially constructed learning. Unlike a student listening to a lecture, a constructivist approach creates a possibility for them to learn through collaboration. According to Vygotsky (Doolittle, 1997) and Dewey (Williams, 2017), collaborative learning is supportive of building a productive learning environment for learners. Vygotsky explained that the cognitive development of a student could be developed by the student individually through the support of peers and teachers (Doolittle, 1997). A student can explore or possess the knowledge to a certain level. However, some of the students may also have additional knowledge, creating the opportunity for the students who have less or no knowledge of a particular area to obtain support from their peers. This was the concept of the Vygotsky's Zone of Proximal Development. He mentioned that the knowledge or skill level of each learner could be developed to a higher level when they collaborate with others (Doolittle, 1997). Hence, the learner will be able to find answers for the unknown areas from the support of group members who have the knowledge and experience. Through support and collaboration, an individual could perform independently in the future. The Zone of Proximal Development was the base for the cognitive development theory of Vygotsky where learners can obtain knowledge collaboratively, and in their long-term learning, they will be benefitted since they can independently perform in the future. Therefore, collaboration can motivate learners to acquire knowledge, exposure, and skills.

John Dewey pointed out that learning collaboratively supports to understand concepts for an individual (Stahl, 2000). Further, he clarified that collaborations could expand the learning experience of a student and working with peers allows the learners to construct knowledge. It can be explained that according to Dewey, students can acquire knowledge through their

experiences. Collaboration supports a live classroom through active participation without limiting students to receive knowledge given by the teacher, memorise it and then reproduce it in the future.

According to the theories about social interactions and collaboration, playing an active and productive role during learning activities, a learner becomes motivated in exploring knowledge. Further, collaborative learning is working as groups while holding responsibility for group members' learning and achieving a given learning activity (Barkley et al., 2014). Ching and Hsu (2013) have suggested that collaboration allows learners to explore knowledge together, disseminate knowledge through group discussions and get feedback from other group members to complete a given task. Learners discuss with each other and solve problems that enable them to develop their critical thinking and problem-solving skills (Yang et al., 2012). Further, communication, leadership, and decision-making skills are essential for learners. They share and evaluate ideas using these skills. Therefore, learners can enhance their cognitive and social through collaborative working (Girvan and Savage, 2010).

Classroom group work or virtual group work can be used to conduct collaborative activities. However, virtual worlds have not yet been used in Sri Lankan education to deliver collaborative work. That is, at present Sri Lankan Higher Education Institutes (HEIs) deliver classroom group activities. Therefore, the research issue is that there is no enough knowledge of students' experiences in virtual group work. We designed our study to address this issue, where we explore students' experiences in virtual collaboration. Based on them, we report their perceptions of using the virtual world for collaborative work. We conduct this study with first-year Information Technology (IT) undergraduate students in HEI.

1.1 Collaboration in Virtual Worlds

Virtual worlds are three dimensional online environments where the participants as avatars collaborate (Girvan and Savage, 2010; Graham and Misanchuk, 2005). Avatars can design the inworld as they prefer to interact with each other (Girvan, 2018). Hence, virtual worlds can be used for collaborative work, and their atmosphere is similar to face to face environment (Monahan, 2008). Therefore, an environment similar to a classroom can be set up in a virtual world. Further, debates, group projects, case study discussions, role-play and simulations can be conducted as collaborative activities in virtual worlds. Through these learning methods, a learner-centred environment can be created in a 3D virtual world (Coffman and Klinger, 2007). Moreover, virtual worlds provide a psychological benefit for the people who engage in it because avatars can interact by being anonymous (Flink, 2019). Since the virtual worlds give the perception of co-presence, the learners can work simultaneously in collaborative activities through interdependence among the group members (Dalgarno and Lee, 2010). This

supports Vygotsky's social constructivism theory (Bulu, 2012),(Bulu, 2012)(Bulu, 2012) (Bulu, 2012) which suggests that co-presence is an essential factor in virtual worlds to create collaboration amongst the learners. Additionally, using virtual worlds for education has been popular since the learners have opportunities to learn with innovation, interaction and uniqueness (Dickey, 2005).

Since the virtual worlds have shown its involvement in education where they are used for experiential or problem-based learning (Cho and Lim, 2017), they can be used as a cornerstone for collaborative work. Similarly, the experience gained through virtual worlds are better, and students can "learn by doing, interact and observe their action" (Bulu, 2012). There, virtual worlds can be used as a technology-enhanced learning approach to collaborative classroom learning. Cho and Lim (2017) suggested that it is important to study on supportiveness of virtual worlds for collaborative work as future research. Hence, in this paper, we present the results and findings on using the virtual world for collaborative work in the Sri Lankan context.

1.2 Background

We conducted the study with first-year Sri Lankan Information Technology (IT) undergraduate students. Due to ethical considerations, we do not provide the name of the institute in this paper. We obtained ethical approval from the University of the West of England and the Sri Lankan HEI.

At present, students engage in classroom collaborative activities. These activities are conducted in the classroom after completing a lecture. The lecturer designs the group work based on the lesson covered on that day, and these activities are either a quiz or a case-study discussion. These activities are designed according to the curriculum, and the curriculum is based on the guidelines provided by ACM (2013). Students work together to complete the activity, and their groups are formed by the lecturer.

These students have not used a virtual world in their courses, and this study was their first experience with the 3D virtual environment. Considering the facts and the growing use of virtual worlds in the Education field, this study will use virtual worlds in creating a collaborative working environment. Further, there is a research gap in using virtual group activities for collaboration in Sri Lankan higher education.

2. Methodology

We conducted this study as fieldwork with 48 IT students who followed Information Systems course in 2017. Before starting the virtual group activities, students engaged in classroom group activities conducted by the lecturers of the institute and the activities they engaged during the period of the fieldwork are;

- Quiz activity 1
- Case-study activity
- Quiz activity 2

We did not have any control over these three activities since the lecturers of the institute conducted them. After students completed these three classroom group activities, we asked them to fill the Likert scale questionnaire in which the Cronbach's alpha value was 0.805. Our sample was a non-probability sample; to eliminate the biases, we chose a random sample for interviews. Hence, we selected random of 27 students to conduct the interviews.

After obtaining data related to classroom group activities, we conducted virtual group activities. First, we trained the students to use the virtual world, and they practised inworld functions and navigations for three weeks. After that, we conducted virtual group work. There were three virtual group activities used in this study. Virtual space is a graphical environment. Therefore, we used the rich graphical content to design the game-based activity and the scenario-based activity. Further, game-based activities create an active and immersive environment that develop group collaboration, decision making and problem-solving skills of the students (Tham and Tham, 2015). The case-study activity was similar to what students do in their classroom. That is, they needed to discuss and develop the answers for the case-study questions but being present in the virtual space. We used case-study activity in the virtual world to explore how students react when they encounter activities that are similar to what they do in the classroom.

- **Game-Based Activity** – This activity was designed in the Second Life® virtual world. It was a game, and its concept was similar to a scavenger hunt.
- **Scenario-Based Activity** – This activity was designed in Kitely virtual world. There were different security vulnerabilities implemented in this scenario where groups needed to find out these vulnerabilities.
- **Case-Study Activity** – This activity was designed in the Second Life virtual world.

After students completed these three virtual group activities, we asked them to fill the Likert scale questionnaire, and we interviewed the same 27 students to collect their experiences on virtual collaboration. The Cronbach's alpha value of this questionnaire was 0.871.

We started this study after obtaining students' written consent to collect data related to their experiences in classroom collaboration and virtual collaboration. There were 99 students enrolled in the Information Systems course and 48 students provided consent to confirm their participation. We started this study in July 2017 and conducted until October 2017. Fig. 1 illustrates the research design of the study.

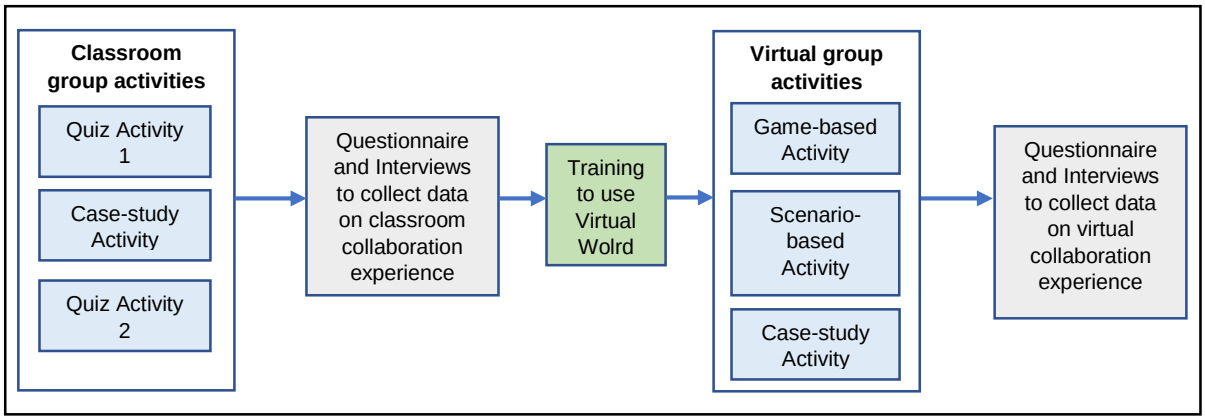

Figure 1: *Research Design*

3. Results and Findings

The questionnaire focused on three areas. These are; interest towards the collaborative activity, usefulness of the collaborative activity and group member participation. 89% of students rated classroom collaborate activities were enjoyable. After they worked in virtual collaborative activities, 100% of students said they are interested in virtual collaborative activities.

Further, 75% of students found that the classroom group activities are useful for learning. After experiencing virtual collaboration, 99% of students commented that virtual group activities are useful for learning. 64% of students stated that their group member participation in classroom group activities is at a satisfactory level. In virtual collaboration, 99% of students said that their group members' participation is at a satisfactory level. Fig. 2 illustrates the results related to; interest towards collaborative activity, the usefulness of the collaborative activity and group member participation.

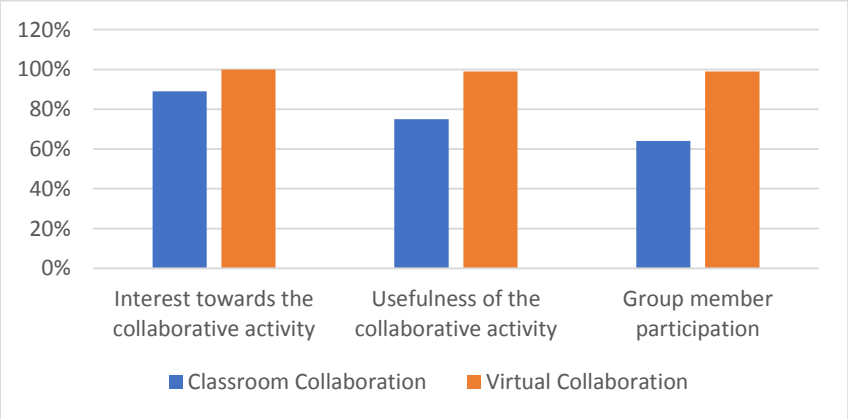

Figure 2: *Classroom Collaboration vs Virtual Collaboration*

We were able to obtain a comprehensive picture of the above results by qualitative analysing the interview data. We used thematic analysis to code interview data (Braun et al.,

2019). After coding interview data; we identified five themes related to classroom collaboration and five themes related to virtual collaboration.

3.1 Classroom Collaboration

The five themes identified related to classroom collaboration shows that students have issues related to classroom group work. We discuss each theme in section 3.1.1 to 3.1.5.

3.1.1 Low Participation of Group Members

"Active participation of the classmates is lacking. Only a certain group of people contribute to the given activities." According to this comment, it shows that some students do not give importance to collaborative work. This may because they do not know how to work collaboratively. Therefore, the members who work always will contribute to the activity while others depend on them. Sometimes, students may have personal barriers such as fear or shyness to communication that limits their participation. However, when group work is given, lecturers evaluate the outcome of these group activities by evaluating only the final work and do not consider any individual contribution in completing the activity. Students may find it unfair due to low participation, and it can be a reason for some students not to give priority to collaborative work. On the other hand, since they know that their contribution is evaluated, they might ignore the group work.

3.1.2 Personal Barriers

"Some people hold their ideas because they think they will say something stupid and others will laugh at them." Students commented that having less knowledge makes them reluctant to share their ideas with the group. They become shy or afraid of making mistakes because of this. Furthermore, they mentioned that the culture or the mindset built on them is another barrier for them to engage in collaborative work. That is passive nature in initiating or engaging in interactions. Communication problems are another issue pointed by the participants of the interview.

3.1.3 Unfamiliar to Collaborative Working

"In our school time, we did not have collaborative work. Teachers come and do the work. In [the] university collaborative work [is done mostly]". Sri Lankan school education system is based on a teacher-centred structure and in higher education, the teaching method changes to the student-centred structure (Marambe et al., 2012). This learning and teaching change in higher education is experienced by the first-year students just as they join HEIs. Collaborative work is one method that can be used for a student-centred learning approach (Wang and Shan, 2017). When students join a higher education course, they can feel this in their learning approach as new, and they find it unfamiliar to engage.

3.1.4 Characteristics of Group Members

"Some people are doing [a] hard work for the team. So that kind of person does not like to do group things because they are the only ones working. If they work individually, it is also the same result." Characteristics of group members can create students to become passive in collaboration. As we discussed in 3.1.1, low participation of the group members can affect the morale of the students who contributes to the collaborative work. Ultimately, these students prefer individual work than group work.

3.1.5 Uninterested in Collaborating

"I think if I stay individual and do individual studies [is] more worth. Because I think in collaborative work, others talk, and it is a waste of time." Some students think collaborative work as a time-consuming task, and they prefer to work alone. Further, a passive collaboration of the group members can be another reason for the students who work in the group to be demotivated. Finally, being unfamiliar to group work students might not understand how to engage in them. Their lack of exposure to collaborative work can make them feel uninterested in collaboration.

3.2 Virtual Collaboration

The five themes identified related to virtual collaboration shows both positive and negative experiences students encountered.

3.2.1 Benefits of Virtual Collaboration

"I prefer the virtual world because using a virtual world you can make implementations which cannot be seen in the classroom". Students think that graphical components of the virtual world are useful to engage in different type group activities that cannot be conducted in the classroom. In this study, we designed a scenario-based activity in the virtual world. The learning objective of this activity was to identify the security vulnerabilities of a business organisation. In real life, students cannot explore the security vulnerabilities of an organisation due to privacy policies. However, this activity was useful for them to obtain practical experience virtually related to this lesson.

"Teachers can watch students for some period to check their progress and how each member participated in the activity." Students preferred virtual collaboration since teachers can observe students' engagement. Therefore, teachers can use this opportunity to observe students' participation, and they can provide any guidance to the students who require assistance. In a classroom collaboration, students' participation was low since the teacher did not evaluate the individual contribution. Hence, they behaved as social loafers depending on the members who work in the group. However, in the virtual world, students cannot behave passively as teachers can observe group member participation in the 3D virtual environment.

3.2.2 Virtual Group Activity Type

Most of the students commented that virtual collaboration activities are exciting. "It is interesting, and we like to engage in such activities rather than the normal activities we are doing in the classroom." In the classroom, they work in a case-study or find answers for a quiz. However, in the virtual world, they worked in a game and role play, and they preferred these types of interactive activities.

In this study, one of the activities used in the virtual world is a case-study. A student said; "Organisational behaviour activity (case study) should be more interactive. It is the same type of activity that we do in the classroom." It shows that the students expect group activities designed in the virtual world to be different and more interactive than the classroom group activities. Further, the interest of the students depends on the type of activity they engage.

3.2.3 Member Characteristics

"In the classroom group activities, only one or two members put all the ideas to the discussion while others just listened. In the virtual world, everybody did the activity and put their ideas and contributed equally." This may be due to the interest students have towards virtual group activities. Further, they know that the visibility of the 3D virtual environment makes them contribute because they know that the teacher can observe their participation.

"Ishara10 (pseudo name of a participant) is a quiet student. She gained the confidence to share her ideas." The virtual world provides anonymity to the participants. That is, they interact via an avatar. This anonymity is useful for students to feel ease in sharing their ideas.

3.2.4 Interested to Collaborate

"In the classroom, some are sleeping, some are writing, and some do other things. However, in the virtual world, we focus on the work, and we achieved that goal together." According to the student, they find it motivating to work in the virtual world. It is different from the classroom environment. The classroom environment is always the same, but teachers can change the virtual environment by designing different activities. That is, in the classroom, they get the same type of group's activities such as case-study, group presentations or quizzes. However, in the virtual world, teachers can design different types of activities.

Further, activities such as a game or a scenario cannot be designed in the classroom due to resource limitations. However, these activities are useful to increase the interest in collaboration with the students. The virtual world is supportive in designing such activities that capture the interest of students.

3.2.5 Limitations

Most of the limitations are related to the technical issues faced during virtual collaboration. "Poor internet connection causing, some images did not load." We used the

multimedia computer lab to conduct virtual group activities. It was the only lab in the institute that matched the computer specification required to run the 3D virtual environment. However, the internet connection was not stable. Therefore, students had to face difficulties in their audio communication and graphics rendering. They managed to communicate via chat in Activity 1 and Activity 2. In Activity 3, students were able to use audio. Further, their avatars did not rez when they engaged in Activity 2. We conducted this activity in the Kitely virtual world. These technical limitations can lead to creating negative attitudes about virtual worlds. Therefore, it is vital for any institute to ensure that the technical resources are sufficient to run the virtual world application.

4. Conclusions

This study reported the students' experiences of using 3D virtual activities to conduct collaborative work. We conducted this in two steps. First, we explored students' experiences in classroom collaboration. After that, we introduced the virtual world environment to the students where they worked in three virtual group activities; a game-based activity, a scenario-based activity and a case-study discussion. The findings showed that students preferred virtual collaboration over classroom collaboration.

According to the results, students found that they are interested in virtual group activities as opposed to classroom group activities. Further, they shared that their interest in virtual collaboration depends on how interactive and how different these activities are compared to the usual classroom activities. Therefore, it is essential for teachers to design virtual group activities that are not similar to classroom activities. The 3D virtual environment has a rich graphical interface; hence, teachers can use this affordance to design interactive and notable activities for collaborative work. Further, students agreed that the virtual group activities they utilised are useful to acquire knowledge compared to collaborative classroom activities. The graphics of the virtual environment provides the ability to visualise scenarios that cannot be illustrated in the real world. Therefore, students find that virtual collaboration is useful.

Moreover, students thought that this visibility allows teachers to observe students' engagement. Hence, the group members know that they need to participate since a lecturer monitors their engagement. This is a fair practice which makes students believe that they need to work interactively. Based on that, students shared the participation of the members in virtual collaboration is higher compared to participation in classroom collaboration. Additionally, students stated that their motivation to work collaboratively increases when they worked in the virtual group activities.

However, the only concern students raised regarding the virtual world was the technical barriers. During the virtual world activities, we experienced internet speed issues and graphics rendering issues. A reliable internet connection and correct graphics specification are essential to run the virtual world application. Otherwise, students and teachers cannot obtain the expected clear graphics or sharp communication inworld. If the institute plans to implement the 3D virtual world in their modules, it is essential to rectify these technological barriers. Otherwise, the students' interest in virtual collaboration can drop.

Finally, in this study, we explained how virtual worlds could be useful to conduct collaborative work compared to classroom group activities. We suggest future studies to explore whether virtual collaboration can be an effective method to conduct group work to eliminate the issues in face to face collaboration.

Acknowledgement

We appreciate all the students who participate in this study. Their comments and perceptions were beneficial to conduct this study. Further, the principal author expresses her gratitude to the University Grants Commission of Sri Lanka for funding this study.

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