Traditional and 3D Virtual Learning Activities: Evaluating Cognitive, Affective, and Psychomotor Learning

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Educating students can be challenging when the content covered requires not only theoretical understanding, but also practical application to enable transfer of learning. Educating counseling and psychology students can be especially challenging as counselors and psychologists need to develop effective clinical skills to interview and diagnose mentally ill patients prior to working as a professional. In this study, the researcher sought to determine if there was a difference in student perceived learning when comparing two commonly used learning activities in a graduate-level mental health and diagnosis course with a learning activity completed in a 3D virtual environment. The purpose was to evaluate student perceived learning benefits of completing learning activities in a 3D virtual environment for understanding and skill development and compare those results to other activities commonly used in educating students. This article will discuss the results of the study as well as explore the cognitive, affective, and psychomotor learning students reported.

The Dilemma

Counselor instructors, much like other educators, need "access to an environment that enables students to meet, discuss, role-play, practice, and complete activities, and that enables instructors to present more authentic didactic examples and supervise students without interference" (Walker, 2009a, p.1). Students should have an opportunity to practice skills they are learning. Baggerly (2002) argued that role-playing enhances active learning and that "pedagogical principles in counselor education call for active learning strategies to engage students in the developmental and collaborative processes" (p. 1). Walker wrote, "Active learning strategies through role-playing and group work practice are important as they help to improve [counseling] skills" (p. 1). Finding a setting and technologies that are effective for role-playing activities can be difficult, as available locations and resources for producing realistic simulations are limited. In the traditional counseling program, counseling educators use role-playing exercises as one of four methods to assist students in developing their skills. Other

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experiences include lectures, case studies, and monitored supervised practice (Beutler & Harwood, 2004 p.318). For online counseling programs, traditional programs without an onsite clinical lab or practice facility and for those seeking patients that exhibit realistic physical and mental traits of an ill client, scenarios, and environments, virtual environments may offer a solution. In a virtual environment, students can practice counseling skills in simulated counseling labs with clients who have emotional responses and physical features that emulate those of a patient who may be suffering from a multitude of problems including abusing substances, committing self-injury, or suffering from an eating disorder, while instructors and other students observe and assist.

Definitions of Terms

Avatar: An avatar is a computer user's representation of himself/herself (Lessig, 2000).

Multi-user virtual world (MUVE): Blaisdell (2006) wrote, "A MUVE (multi-user virtual environment) is an interactive computer simulation of a geographical area, say a town, where features of the environment— buildings, rivers, stairways, people—are represented by computer graphics" (p. 28).

Second Life: A three dimensional (3D) multiple-user virtual world created by Linden Labs.

3D Virtual Environment: Koster (2004) wrote, "A virtual world is a spatially based depiction of a persistent virtual environment, which can be experienced by numerous participants at once, who are represented within the space by avatars" (Terranova Blogs, Msg 21).

Virtual Counselor Training Facility and Customized Patient Avatars

To provide students with a location to practice their role-playing exercises, a virtual counselor training facility was created in the virtual world, Second Life. On the second floor of the building were six counseling lab rooms, which emulated counseling labs in a clinical counseling facility and a school counselor office. All of the lab rooms were furnished and decorated with items typically found in a counselor's office or lab room and all of the labs had a one-way mirror to enable observation by the instructor and peers. The counselor training facility was located on private land in the virtual environment. Access to the facility was restricted the course instructor, the students enrolled in the course, patient avatar controllers, and the researcher.

Two customized patient avatars who displayed the physical traits of mentally ill clients were created for the student role-playing activities. The physical injuries displayed by the self-injury avatar and the thin features of the eating disorder avatar increased the realism of the environment and the role-playing activity (see Figures 1 and 2). Both avatars were female, as the volunteers for controlling the patient avatars were both female. A licensed clinical counselor controlled the eating disorder avatar and a graduate level counseling student who had completed the mental health diagnosis course controlled the self-injury avatar.

Figure 1. Avatar with the eating disorder.

Figure 2. Self injury avatar's physical injuries.

Participants

The sample for this study consisted of 25 students enrolled in a mental health diagnosis course, a required course in the master's of counseling program at Northern Illinois University. The participants ranged in age, technology experience, and time in the program. Eleven of the participants were female. The majority of participants were ages of 22-30 and one was over 50 years old. Participant technology experience ranged from little experience to very experienced. Participants' responses indicated 50% had participated in an online or hybrid course. Thirteen participants, or 81%, claimed they were somewhat technology literate, while two students claimed they were very technology literate. Three participants claimed they had never played a computer game. Two participants reported they had never used any Web 2.0 tools such as instant messenger, YouTube, Facebook, blogs, wikis, or other social networking and interactive online technologies, while all other participants had some experience with at least one type of web-based tool. Four participants reported they had played some type of MUVE in the past; however, none of the participants had ever entered Second Life.

Research Design and Instrument

During the study, participants completed the following learning activities: (a) a literature review and discussion, (b) a video or other visual experience and discussion, and (c) role-playing and discussion in a 3D virtual environment. The researcher compared student reported comprehension for each learning activity. Students who agreed to participate in the study

completed a 9-question student perceived learning instrument after each learning activity. To account for the possibility of unit content making a difference, the researcher evaluated student responses from two units in the course (eating disorder and self injury), with each unit containing three identical activities (literature review and discussion, video and discussion, 3D virtual and discussion). Each participant completed six perceived learning surveys.

The self-report Perceived CAP Learning Scale, with a minimum and maximum perceived learning scale of 0-54, was used to measure student perceived cognitive, affective, and psychomotor learning. Items on the survey include questions that ask students to estimate how much they learned, whether students can explain course material to others, if students can repeat the physical expectations they learned, and overall perception of amount of learning.

The perceived learning surveys were analyzed using descriptive and inferential statistics. The researcher determined the mean, median, and standard deviation for each of the three types of activities. General assumption testing was conducted to check for homogeneity of variance, independence, and normality. No serious violations of the assumptions were noted, although there was some skewing when evaluating the normality. Because the power of an ANOVA might be significantly reduced when normality is not met, a nonparametric test was conducted to ensure the results were not affected by the normality difference. A one-way repeated-measures ANOVA was used to determine if there was a difference in perceived learning between the three learning activities. An ANOVA, which tests the differences between several means, provided information about the participant's self-reported learning on each of the three activities for each of the two units.

Results

The researcher sought to determine if there was a difference in student perceived learning when comparing two commonly used learning activities in a course with the use of a 3D virtual environment for practicing student interviewing and diagnosis skills. The results of the perceived learning survey showed students reported significantly higher learning benefits from the 3D virtual environment activity than the literature review and discussion and video and discussion activities.

Each student received a total perceived learning score for each of the three activities (literature review, video, and 3D virtual). The total perceived learning score for each activity was obtained by adding together the student's perceived learning scores for each of the two perceived learning surveys students completed for each of the three activities during each of the two course units (eating disorder and self injury). The outcome was one perceived learning score for each participant for each type of learning activity across two units. Table 1 provides the total perceived learning score for the three activities.

Table 1
Total Perceived Learning Scores Across Two Units for Three Activities

Participant	Literature Review and Discussion Activity	Video and Discussion Activity	3D Virtual Learning Activity
1	42	42.5	48

2	32	40.5	49
3	44	46	50.5
4	33.5	31	38
5	45	48	47
6	39	43	47.5
7	41.5	37	47
8	34.5	35.5	40.5
9	41	42	49.5
10	44	38.5	47
11	46.5	41.5	47.5
12	37	35.5	39.5
13	37.5	37.5	42
14	36.5	41	49
15	39.5	36	40
16	39.5	36.5	42

Descriptive Statistics

Means for each of the three activities across the two units ranged from a high 45.25 on 3D virtual to a low 39.50 on video. Table 2 displays the descriptive statistics, including means, medians, and standard deviations for the different three activities during the two units. The standard deviations ranged from 4.14 on 3D virtual to 4.37 for video. Based on the data displayed in Tables 1 and Table 2, students rated higher perceived learning for the 3D virtual activity than for the other two activities with a mean of 45.25. Only participant 5 scored one activity higher than the 3D virtual activity (see Table 1). The literature review activity was rated second with a mean of 39.57, and video was rated third with a mean of 39.50. A profile plot, Figure 3, provides a visual of the difference in perceived learning students reported.

Table 2
Descriptive Statistics of the Total Scores for the Three Learning Activities

	M	*SD*	*N*	Minimum	Maximum
LitReview	39.57	4.23	16	32	46.5
Video	39.50	4.37	16	31	48
3D Virtual	45.25	4.14	16	38	50.5

Note. Likert scale for perceived learning, i.e. 0 = not at all, 6 = very much so

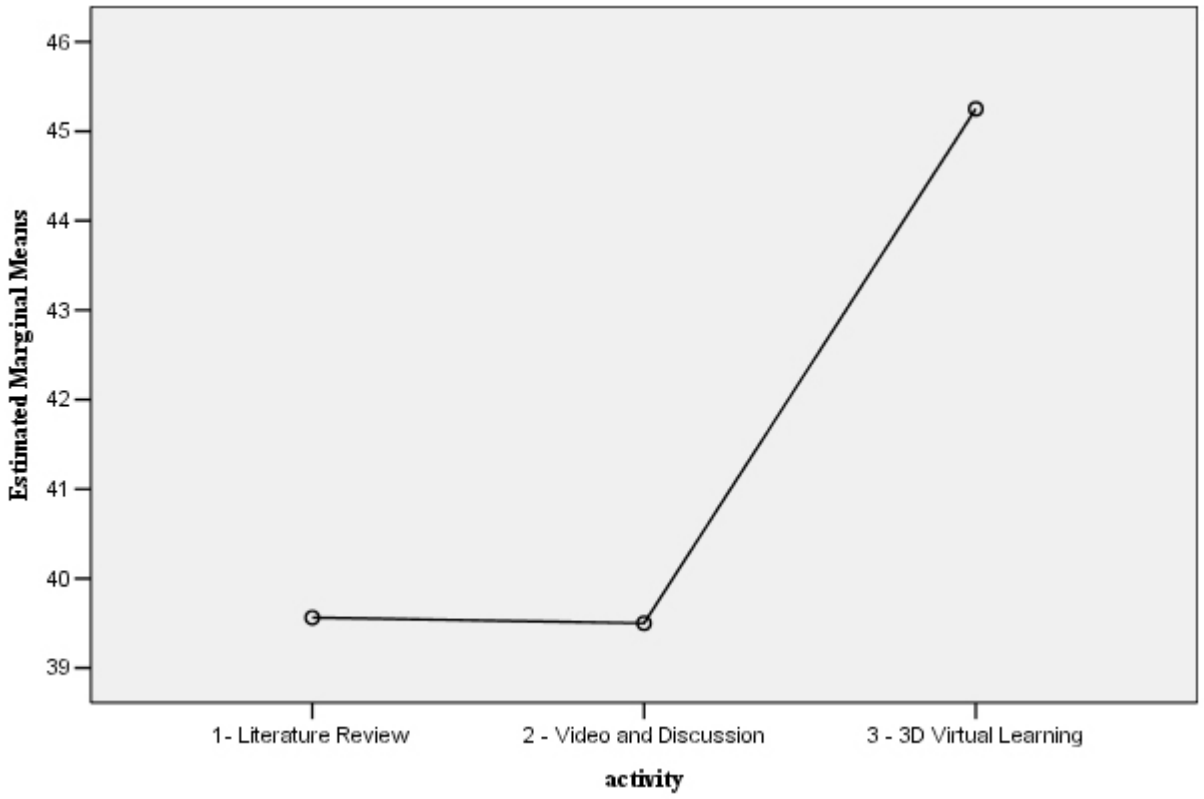

Figure 3. Profile plot of activity mean scores.

Inferential Statistics for Activities

A one-way repeated-measures ANOVA was conducted with 16 participants (N=16) using alpha .05, to determine whether there were mean differences in the scores of the six self-reported perceived learning surveys. The following null hypothesis was tested: There is no difference in perceived learning between learning activities in a graduate mental health diagnosis course.

The standard univariate ANOVA indicated a significant activity effect, $F(2,30)=25.62$, $p<.01$, partial $\eta^2=.63$, observed power = 1.00. The alternative univariate tests—Greenhouse-Geisser, Huynh-Feldt, and Lower-bound—yielded the same F value. Multivariate tests were also conducted. The multivariate test, Wilks' Lamda, indicated a significant activity effect, Wilks' Lamda = .16, $F(2, 14)=37.79$, $p<.01$. Therefore, the null hypothesis was rejected. There was a significant difference between the perceived learning students reported for the three activities. The results of the Friedman's and Kendall's tests was significant for differences between the student reported perceived learning: Friedman's, $\chi^2 = 21.56$ (2, N=16) = $p < .01$, Kendall's W = .674.

Within subjects contrasts were completed using the repeated contrast method to review differences in means between levels. Based on the contrast results, the video activity and the 3D virtual activity differed the most, $F(1,15)=79.35$, $p<.01$, while the literature review activity and the video activity were most similar, $F(1,15)=.0$, $p=.10$. Students reported a significant difference in their perceived learning between the video activity and the 3D virtual activity. Students had similar perceived learning results during the literature review and the video activities.

Cognitive, Affective, and Psychomotor Learning

The cognitive, affective, and psychomotor learning is also of interest as the research instrument allowed the researcher to evaluate the scores students reported by type of learning. Differences in cognitive, affective, or psychomotor learning may show interesting differences in the types of learning students experienced during the three activities.

Means for the cognitive scores ranged from a high of 26.69 for Cog_Virtual to a low of 21.38 for Cog_Lit. Table 3 displays the descriptive statistics, including means, medians, and standard deviations for the cognitive scores. The standard deviations ranged from 2.68 on Cog_Virtual to 4.53 for Cog_Video. Based on the data displayed in Table 3, students rated higher perceived cognitive learning for the 3D virtual activity than for the other two activities with a mean of 26.69 and the lowest perceived cognitive learning for the literature review activity.

Table 3

Descriptive Statistics for Cognitive Learning Reported for Each of the Learning Activities

	M	*SD*	*N*	Minimum	Maximum
Cog_Lit	21.38	3.879	16	15	29
Cog_Video	22.88	4.530	16	16	33
Cog_Virtual	26.69	2.676	16	23	32

Means for the affective scores ranged from a high of 35.63 for Affect_Virtual to a low of 27.06 for Affect_Lit. Table 4 displays the descriptive statistics, including means, medians, and standard deviations for the affective scores. The standard deviations ranged from 3.16 on Affect_Virtual to 3.09 for Affect_Lit and Affect_Video. Based on the data displayed in Table 4, students rated higher perceived affective learning for the 3D virtual activity than for the other two activities with a mean of 35.63. Affect_Lit and Affect_Video had near identical affective learning results.

Table 4

Descriptive Statistics for Affective Learning Reported for Each of the Learning Activities

	M	*SD*	*N*	Minimum	Maximum
Affect_Lit	27.06	3.087	16	19	33
Affect_Video	28.25	3.088	16	24	36
Affect_Virtual	35.63	3.160	16	29	42

Means for the psychomotor scores ranged from a high of 28.00 for Psycho_Virtual to a low of 20.94 for Psycho_Lit. Table 5 displays the descriptive statistics, including means, medians, and standard deviations for the affective scores. The standard deviations ranged from 3.28 on Psycho_Video to 2.19 for Psycho_Virtual. Based on the data displayed in Table 5, students rated higher perceived Psychomotor learning for the 3D virtual activity than for the other two activities with a mean of 28.00.

Table 5

Descriptive Statistics for Psychomotor Learning Reported for Each of the Learning Activities

	M	*SD*	*N*	Minimum	Maximum
Psycho_Lit	20.94	2.955	16	17	27
Psycho_Video	21.75	3.276	16	17	28
Psycho_Virtual	28.00	2.191	16	25	34

Discussion

An analysis of the results of student perceiving learning by activity determined students perceived using a 3D virtual environment for role-playing activities as beneficial. There was a statistically significant difference when comparing student perceived learning between the three learning activities; with the 3D virtual environment obtaining the highest student perceived learning scores. Specifically, the students perceived they learned more during their activities in the 3D virtual environment (*M*=45.25) than the other activities completed. The perceived learning results indicated that students reported slightly more learning from their literature review activity (*M*=39.57) than from their video and discussion activity (*M*=39.50).

When reviewing student reported differences in cognitive, affective, and psychomotor learning for each of the activities, that the results show that students reported the 3D virtual activity provided them with the highest cognitive (*M*=26.69), affective (*M*=35.63), and psychomotor (*M*=28.00) learning. It is not surprising that students reported the 3D virtual activity provided them with the highest level of cognitive, affective, and psychomotor learning, as the results of the ANOVA and posthoc tests showed students felt the 3D virtual activity provided them with the best learning overall. The video activity had the second highest mean for

cognitive (*M*=22.88), affective (*M*=28.25), and psychomotor (*M*=21.75) learning. It is interesting that the video activity has the second highest score for each of the types of learning, as the video activity was slightly lower than the literature review activity in the results of the ANOVA test comparing overall perceived learning. In addition, 50% of the students had reported a drop in overall perceived learning from the literature review activity to the video activity. However, the mean differences between the literature review activity and the video activity for each of the types of learning is small, (cognitive 1.5, affective 1.19, and psychomotor .81). Therefore, the results indicated that students reported slightly less learning from their literature review activity than from their video activity for each of the areas of learning.

The difference between the means for each of the types of learning provides insight into student's opinions of their learning for each of the activities. For example, the mean difference between the cognitive mean for the literature review activity and the video activity was small at 1.5. However, the mean difference between the video activity and the 3D virtual activity was larger at 3.81, or a 14.28% increase in cognitive learning from the video activity to the 3D virtual activity. The same was found for the affective and psychomotor activities. The mean difference between the affective mean for the literature activity and the video activity was small at 1.19. However, the mean difference between the video activity and the 3D virtual activity was quite a bit larger at 7.38, with a 20.71% increase in affective learning from the video activity to the 3D virtual activity. The largest difference was for the perceived psychomotor learning. The mean difference between the literature review activity and the video activity was small at .81, however the mean difference between the video activity and the 3D virtual activity was quite large 6.25 representing a 22.32% increase in psychomotor learning from the video activity to the 3D virtual activity.

Success of the use of the 3D virtual environment in the course was most likely due to several factors. I will discuss a few of these. First, students were able to take what they had been learning in their texts books, individual research assignments, class discussions, case-study video activities, and even other classes and apply those skills in active learning activities through role-playing different scenarios. Second, students learned together, supporting each other, and with the support and supervision of their instructor, using a technology that enabled students to see the clinic, the patient, and themselves counseling a patient, as well as viewing other students practicing their skills during the role plays. The social learning opportunities of this environment are tremendous. Third, are the visual benefits of using virtual environments for simulations and role-playing. The facility was designed to give students the visual features they might expect of a counseling lab or a school counselor's office. For example, students needed to use an elevator to go from one floor to the next, open a door to enter a room, or pick up a Kleenex with their avatar's hand. Fourth, the students did not know the patients they interviewed and the patients exhibited the physical traits of a patient with an eating or a self-injury disorder and responded to questions as a mentally ill patient may respond. Often students are paired with a classmate or they are asked to locate a friend or family member they can practice with. All of these aspects added to the realism of the activity, something that is difficult to produce in other environments using peer-on-peer practice or practicing in a classroom or at home with a family member.

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