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The impact of situated learning activities on technology university students' learning outcome

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Abstract

Purpose – The purpose of this study was to investigate 3D virtual reality (VR) situated activity, preschool reality and how the lecture teaching method affects technology university students' learning outcome.

Design/methodology/approach – The quasi-experimental design is used. Participants are 144 students in three classes who all take Child Development Assessment course. Research instruments include 3D VR animation, preschool live video and child development as the case. One class attended 3D VR situated activities, another observed preschool live video and the other takes a traditional lecture class. Learning outcomes were measured by two paper-and-pencil tests in different times and with one performance assessment. In the writing test, mechanical and meaningful questions were included.

Findings – Major findings of this study are, first, that the auxiliary learning of 3D VR is better than the real-life situation. Second, situational learning activities can enhance participant performance in context-based questions. In summary, this study found that well-organized 3D VR animation is more effective than live situation learning, especially for context-based course content.

Research limitations/implications – The lack of random assignment into test groups leads to non-equivalent test groups which can limit the generalizability of the results to other student population.

Practical implications – The findings of this study suggest that teachers can gradually arrange learning activities, from 3D VR to a real applied workplace; situated learning activities are more likely to support the transfer knowledge to real-life problem solving.

Originality/value – The findings suggest that teachers in arranging the classroom context activities can be the first to use 3D VR before actual reality to avoid novices getting lost in the complicated real situations. If learning activities can be arranged gradually, from 3D VR to real applied workplace, situated learning activities can help students to deploy their newly acquired knowledge and skills in real-life problem solving.

Keywords Situated teaching, 3D virtual reality, Situated cognition, Vocational education, Computer assisted instruction

Paper type Research paper

Introduction

The primary function of vocational education is to meet the workplace need for skilled manpower (Baartman and De Bruijn, 2011). Students of vocational education institutions acquire not only academic knowledge but also the abilities they need to apply at work. Instruction should offer more opportunities for students to solve practical problems as well as strengthen their capability in real-work situations.

Since the student-centered teaching method emphasizes the needs of students, they become interested in participating in learning. Traditional school learning is criticized because it creates contexts for learning that strongly differ from "real-life" application contexts. Even when students get a high score in a course, they often cannot apply their knowledge to solve real problems in their future work. To solve this problem, learning contents must be closely linked to the real-life requirements of learners. Students would then be more likely to actively participate in the curricular activities. When students have the opportunity to solve real problems, even if their attempts fail, students will find these

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experiences fruitful through reflection and improvement. Brown and Collins (1988) stated that learning is a process of enculturation. Meaning and value will only happen when learners become involved in real community practice. Situated context has the function of an index, and these cues help people develop internal representation at the time of the formation of memories. Internal representation with index can help learners extract knowledge easily and apply it in situations when needed.

Dale (1969) indicates that the least effective learning method involves learning passively. Information presented through verbal symbols and lectures can hardly attract students' learning interest. In contrast, the most effective learning method involves the student actively participating in "simulate, model, experience a lesson" or "do the real thing" activities. The study of Gifford and Mullaney (1998) based on Dale's findings, which was conducted by the National Training Laboratories, produced the Learning Pyramid. The Learning Pyramid investigated the average retention rates for different teaching methods; the lecture method was found to provide the least retention. Practice by doing, or by teaching others, were found to provide the most retention. Thus, simulations should be more efficient modalities for learning.

Educational simulations have a lot of advantages for learning. Simulation-based learning enables students to use their procedural knowledge in a relatively safe environment that resembles reality (Oortwijn *et al.*, 2008). Simulation practice may promote students' procedural knowledge through a "learning by doing" process. The most common educational simulations allow students to practice their skills in working reality such as facility practice or restaurant internship. However, the setting of real situations is associated with high cost because of required space and the need for lots of equipment. Virtual reality (VR) simulations can be very flexible for providing different situations, especially for dangerous or expensive ones such as flight or architecture. Educational simulation is especially important for some departments like child care or nursing. Service objects of these professionals are patients or children without self-protection ability. Freshmen and sophomores without enough professional training are usually unable to get permission to care for children. Thus, 3D VR is probably suitable for students' need for practice.

On the other hand, some studies indicate that simulations have several disadvantages compared to other modalities. Because educational simulations are often used with problem-based learning approaches, learners have to immerse themselves into a problematic situation (Heinich *et al.*, 2001). This type of learning often costs more time than other methods. The other defect is that without appropriate coaching and scaffolding (Duffy and Cunningham, 1996), or feedback (Leemkuil *et al.*, 2003), the learner probably gains little from the exploring process (Min, 2001).

Perhaps that is one of the reasons that while the teaching technology has been very progressive, the traditional one-to-many lecture is still a prevalent teaching method in classrooms today. It is efficient in the delivery of large amounts of information in a short period of time. The disadvantage of this method is the lack of learner engagement in lecture settings. In order to promote students' understanding of practical issues, case study and discussion are often used in the classroom.

Education simulations aim to imitate real teacher, classroom and teaching tasks, or to mirror real-life situations in which teaching processes are rendered. Simulated learning has the potential to enable both students and teachers to engage in critical analysis of situated task, reflect on their thinking, skills, sense of critique and ability on decisions making. Application of simulated learning may improve time management, decision making and critical thinking skills; also, it may increase students' preparedness and confidence in classroom management experiences; last, it may enhance their self-efficacy and practical performance. The purpose of teacher education is to have students prepared with the knowledge, skills and features of professionalism needed in educational practice. The research of simulation seeks to make the teaching process more efficient and economical.

Many researches investigated the benefits of educational simulation but few studies examined the effect of different kinds of simulation such as VR and live video. The present study complements the insufficient literature in this area. In sum, there are different ways in which the curriculum can provide students with practical contact and simulation exercises. The digital simulation method provides students with online learning convenience anytime and anywhere. Live video is probably the most realistic way to observe people. Case study in classrooms is a convenient and economical way to understand practical issues. Which method is more effective for enhancing student performance? It's one of the main questions that this study tries to examine.

Literature review

Situated learning

Situated learning theory posits that learning is necessarily situated and is a process of participation of practice for solving practical problems. Lave and Wenger (1991) claim that practical knowledge is situated in relations among practitioners, social organization and the communities of practice. For this reason, learning should involve such knowledge and practice (Lave and Wenger, 1991). In the situated learning approach, knowledge and skills are embedded in the context of real life. Contexts of curriculum reflect how knowledge is obtained and applied at the job and in everyday situations.

The core perspective of situated learning is similar to that of vocational education. Situated learning theory advocates a curriculum formed as a situational context for learning, which appears like possible application situations, in order to ensure that learning activities in the classroom foster problem-solving abilities. Simulation is a "hands-on" educational modality, acknowledged by learning theories to be more effective than other methods (Ziv, 2009). It provides the learner with opportunities to become engaged in the simulated context. This context allows learners to become involved in activities that stimulate them to apply the curriculum knowledge they are learning so that they will have the ability to apply it in different situations. Transfer of knowledge is a critical feature of educational simulation.

A three-dimension virtual world provides representations of 3D space somewhat similar to that found in real world (Dickey, 2005). VR technology is widely applied in many areas, such as entertainment and pilot training. Researchers indicate that 3D interactive environments provide support for situated and constructivist-based learning activities by allowing learners to interact directly with people and surroundings (Kelton, 2008; Wagner and Ip, 2009). Three-dimension scenarios in courses enable students to quickly apply what they have learned in order to solve problems.

The constructivist paradigm posits that learners take an active role in their learning process since they not only absorb information but also connect it with previous knowledge to construct new knowledge. Obtaining knowledge is not a passive registration of the external world, but rather active construction learning. People's knowledge is based on everyone's experience in the environment. Both Dewey and Piaget believe that the teacher's role is offering learners' real experience and guiding them to understand which surroundings tend to promote positive learning experiences (Kolb, 2014; Ornstein and Hunkins, 2008). The main function of education is to improve the reasoning process. Therefore, curriculums should be real and applicable for students' life. In the present study, the following questions will be investigated: Questions 1. Do different learning activities have a significant effect on students' learning retention in post-test and delayed post-test? Questions 2. Do different learning activities have a significant effect on students' scores in performance tests?

Problem-based learning

The major concern of vocational education is how to facilitate students' practical knowledge and skills; thus, teachers have to decide what students need to learn in order to develop the necessary abilities in their future work environment. Problem-solving ability is one of important capabilities in learning in twenty-first century (Dede, 2010). The aim of problem-based learning (PBL) is to improve the weaknesses in didactic instruction by encouraging learners to develop an independent thinking ability and collaborative learning (Brenton *et al.*, 2007). PBL is a learner-centered approach that encourages learners to solve problems in real life.

Contextual design on cognition has also engendered a critical part of PBL instruction, exercising an important influence on the authenticity and autonomy elements of project-based learning. If instruction is carried out in a problem-solving context, students will be more able to apply what they learn to making decisions and solving problems (Bridges *et al.*, 2015). In other words, learning that occurs in the context of problem solving is more likely to be retained and applied. Such learning method is seen as being more flexible than the inert knowledge which is acquired from traditional didactic teaching methods (Tynjälä and Gijbels, 2012).

PBL is an approach with several versions and variations. PBL can be conceptualized in two overarching categories: simulated problem learning and authentic problem learning. Simulated PBL often uses a problem created by an instructor or others or an actual one that has already occurred. Authentic problem learning utilizes a "live" problem which needs to be solved. Both kinds of learning are learner-centered (Cordeiro and Campbell, 1995).The emphasis of a learner-centered approach is on guiding and supporting students as they learn to construct their own understanding of the surrounding in which they live (Brown *et al.*, 1993; Brown *et al.*, 1989; Duffy and Cunningham, 1996). In a learner-centered classroom, content is used to establish a knowledge foundation. Students' abilities and skills are developed through the study of, and discussion on, the course content. These abilities are not only for a single course, but rather are the sophisticated skills necessary to sustain learning across a career and lifetime (Weimer, 2002).

One of the ways to create authentic instruction is to anchor that instruction in a realistic event, problem or theme. Anchored instruction is fixed within a real-world event that is appealing and meaningful to students (Herrington *et al.*, 2006). The core idea of this kind of course is to let students experience the intellectual changes that experts experience when they solve a real problem in reality. One of the famous anchor instructions is CTGV's project called the *Jasper Woodbury* series (CTGV, 1992). Jasper is a video-based series designed to promote problem-posing and solving abilities. Currently, digital and information technology has been more progressive than before; therefore, video-based learning material can be replaced by 3D VR or other types of materials. Questions 3 and 4 will be examined in this study: Do students of 3D VR achieve better performance in context-free test items? Do students of 3D VR have better performance in context-based test items?

According to the literature mentioned above, being situated in simulation in contact with future work, motivation to learn is strong. However, it is not easy for students to apply knowledge in workplace. PBL is a form of student-centered teaching deliberately structured to support development of students' theoretical understanding and professional reasoning. When different technologies, such as 3D or synchronous online video, are embedded in an authentic learning environment, will richer visual and auditory stimuli affect students' learning? Both VR and immediate video connection with a practical site can help teachers to establish authentic learning environments, but which learning environment setting is the most conducive to learning? Does it support transfer of knowledge from classroom to practice for problem solving? Ongoing research is needed to better understand how different authentic PBL learning arrangements result in short- and long-term effects.

This paper is structured around the following hypotheses:

H1. Three-dimensional VR learning activities have a positive effect on students' learning retention in post-test and delayed post-test.

H2. Three-dimensional VR learning activities have a significant effect on students' scores in performance tests.

H3. Students of 3D VR achieve better performance in context-free test items.

H4. Students of 3D VR achieve better performance in context-based test items.

Methodology

Research design

The aim of child development assessment courses is to train students' ability regarding child development screening. In this quasi-experiment, participants were recruited from existing classes. Sample students belong to three classes using different learning materials and methods. One class is the experimental group using 3D VR, another class uses real-time connection video and the third class uses a child development case in paper form. The teacher of three classes is same.

Pencil tests were conducted three times. The pre-test was held in the first week of the semester to determine the level of course knowledge. The post-test and postponed-test were held before the end of semester. Two categories of testing questions were included: mechanical and meaningful questions. Mechanical questions are context-free multiple-choice questions which ask about learners' knowledge of the child development checklist. Meaningful questions are context-based and embedded with real-world problems or situations. Context is highly relevant to child development screening practice.

Learning outcomes are evaluated not only by pencil test but also by a practical performance test. The major content of the examination is development screening knowledge and practice of the 4-year-old child. The experimental design is shown in Table 1.

Participants

Participants are 144 sophomores who took child development assessment courses in the Department of child care and education. All participants enrolled in a technology university in mid-Taiwan. Students belong to three classes. Different learning materials including 3D VR, live video from preschool classroom and child development case are used separately in the three classes.

Instruments

(1) 3D VR animation

The scenario of VR animation is based on Preschool Children Developmental Checklist (PCDL). PCDL includes 13 sub-checklists for children from 6 months to 6-years-old. The present study selected all the items of the 4-year-old's checklist for the animation scenario.

Class	Pre-test	Experimental variable	Post-test	Postponed-test
3D VR	O_1	3D virtual reality animation (X1)	O_2	O_7 O_8
Live video	O_3	Preschool live video (X2)	O_4	O_9 O_{10}
Didactic teaching	O_5	Child case in paper form (X3)	O_6	O_{11} O_{12}

Note(s): O_1, O_2, O_3, O_4, O_5, O_6, O_7, O_9, O_{11} is paper-and-pencil test; O_8, O_{10}, O_{12} is performance assessment

Table 1. Experimental design

The 4-years-old checklist was selected if children with developmental delays still have 2 years to remedy before elementary school. There are 10 items in this checklist, such as “jump off the ground by two feet” or “Can say application of four objects, such as cup, key, shoe and pencil”. The scene of VR animation is a preschool, and the characters are child and teacher. Physical activity, oral performance and social interaction can be observed in the animation. All 10 checklist items are embedded in the activity in the film.

Expert validity of animation was examined by two child development professors and two senior preschool teachers. The learning website was built using the MySQL program and PHP language. VR animation and questions are set in this platform. Students can watch film repeatedly at their own pace.

(2) Preschool live video

The preschool participating in this study is an affiliated institution of a university which recruits children from 2 to 6-years-old. Camera and microphone were installed on the ceiling in every classroom. Screen angle and distance could be adjusted by the remote-control lever. Synchronous video of children’s activities was transferred to the university classroom. In this study, the class of the 4-year-old was observed by the sample’s students.

(3) Child development case

The scenario of 3D VR animation was printed as a handout for each student. According to PCDL, students evaluated the development status of target child and judged whether or not this child developed normally. Students also wrote down the reasons for their judgment.

(4) Child development evaluation paper-and-pencil test

Examination items were based on PCDL. Each development field (motor, cognition, language and social) was designed with at least one multiple-choice item in each age (4 months to 6-years-old). Preliminary procedure involves an edition of approximately 60 items, followed by expert validity and item discrimination. A final edition with 30 selected items was organized into a midterm examination containing multiple-choice items under two categories of mechanical and meaningful subscales.

(5) Child development performance assessment

The researcher filmed the 4-year-old’s activity in the preschool. The content of the film presents the status of free play, and the physical condition can be observed. In the film, the teacher asks the target child several PCDL screening questions; the performances of cognition and language are shown. Students watched this video in the class and wrote down their judgment and reasons regarding the target child’s development status. Students’ answers are scored in Table 2 rubric.

Procedure

The schedule of three classes of child development assessment in 18 weeks overall was arranged in the following order.

(1) Course introduces basic concepts, theories and practice of child development assessment from week 1 to 8. During this period, the teacher prepared all the teaching and research materials, and explained the live video affair to the preschool teacher.

(2) Two child development scholars were invited as performance assessment raters. Training of rater of performance assessment was held from week 5 to 8. During the training process, two raters communicated their different judgments regarding the training video according to the rubric. Final rater reliability reached 0.92.

(3) The midterm examination was held in week 9 for all three classes. The examination content was the same for all classes which used the child development evaluation paper-and-pencil test. The scores of the midterm examination were used as the pre-test score. The scores of three classes were analyzed by ANOVA, and the result shows $F = 2.22$, $p = 0.08$. It means the initial level of child development evaluation among classes was similar.

(4) The theme of the course in week 10 was child motor and sensory development. The three classes each used VR on website, live video with preschool and case in paper form as the learning material. Students in the 3D VR group used a computer to access the learning website in the class. Students watched preschool children via live video in the class. All the students learned cognition and language topics in weeks 11 and 12, in the same way as week 10.

(5) In week 13, the teachers and students discussed the course content topics of the last three weeks. Any questions about previous topics were discussed and answered. Then the first time post-test was held.

(6) Themes of emotions and social ability were taught and discussed from week 14 to 16. Students and the teacher had a final discussion of the course in week 17; a performance assessment was held that week.

(7) There was a final examination in week 18. The scores were used as the delayed post-test scores.

Data analysis

This study has attempted to compare which method is more effective for enhancing student performance. Descriptive statistics and ANOVA tests were calculated using the Statistical Package for Social Sciences version 19.0 for Windows. Post hoc comparisons (Fisher's PLSD) were then used when analysis of variance was significant to compare data two by two.

Results

For our first question of the present study, we investigated whether different learning activities have a significant effect on students' learning retention in post-test and delayed post-test results. The result of the paper-and-pencil test shows no significant difference in the post-tests among the three groups. However, significant difference is found in the delayed post-test. Post hoc analysis with the scheffé method indicates that the retention of the 3D VR group was better than that of the live video group (see Table 3). Our first hypothesis was partly confirmed. It is noteworthy that the mean score of the didactic teaching group is even higher than that of the live video group, although the difference is not significant.

Table 2. Rubric of performance assessment

Item	Standard
Number of correspondence	0–10 points according to correspondence of item
Number of accuracy	0–10 points according to accuracy of items
Coverage ratio	2 points-explain correct reason for more than two child development fields, 1 point-one field, 0 point-none
Accuracy of final result	1 point-correct judgment for overall result 0 point-wrong judgment for overall result

Note(s): *Total score is 23 points

In the second question, we seek to answer that if different learning activities have a significant effect on students' scores in performance tests. Besides the paper-and-pencil test, students in all three groups took the performance assessment. With this practical test, students watched the film of the target child's various activities in school life. According to the standard of PCDL, learners had to judge his developmental status in the physical, cognition, language and social fields, and then make an overall judgment of this child's development. Students' answers are scored by a previously announced rubric. The results in Table 4 show significant differences among the performance assessment scores of the three groups, and Hypothesis 2 was accepted. Students in the 3D group had the best performance, the didactic teaching group was in second place, followed by the live video group. It shows that well-organized simulation learning is more effective than live situation training for students. Table 5 presents the scores of the three groups for the four scoring items. The scores of the didactic group are higher than those of the live video group for the previous two items, while those of the live video group are higher than the didactic group's in both coverage ratio and accuracy of the final result item. In other words, although students of the live video group

Table 3.
Results of the post-test and delayed post-test among the three groups

Test	Group	*M*	SD	*F*	*p*	post hoc
Post-test	3D VR	71.12	20.37			
	Live video	68.49	14.70	0.71	0.492	
	Didactic teaching	66.43	21.45			
Delayed post-test	3D VR	65.43	17.02			
	Live video	56.62	14.22	4.17	0.017*	3D > Live video
	Didactic teaching	61.69	15.08			

Note(s): $*p < 0.05$

Table 4.
Results of performance assessment among the three groups

Group	*M*	SD	*F*	*p*	post hoc
3D VR	20.81	2.31			3D > Didactic
Live video	7.32	2.02	360.41	0.000***	>Live video
Didactic teaching	16.38	3.29			

Note(s): $***p < 0.001$

Table 5.
Results of scoring items of performance assessment in the rubric

Item	Group	*M*	SD	*F*	*p*	post hoc
Number of correspondence	3D VR	9.78	0.85	522.84	0.000***	3D > Didactic
	Live video	2.59	1.17			>Live video
	Didactic teaching	8.05	1.43			
Number of accuracy	3D VR	8.61	1.27	236.85	0.000***	3D > Didactic
	Live video	1.84	1.17			>Live video
	Didactic teaching	6.05	2.20			
Coverage ratio	3D VR	1.92	0.28	5.77	0.004**	Live video > Didactic
	Live video	1.98	0.14			
	Didactic teaching	1.76	0.49			
Accuracy of final result	3D VR	0.94	0.24	5.01	0.008**	Live video > Didactic
	Live video	0.98	0.14			
	Didactic teaching	0.80	0.40			

Note(s): $**p < 0.01$, $***p < 0.001$

failed to notice some details in the film, they still showed great accuracy by intuitive judgment regarding final judgment of the episode.

The present study showed similar result as some previous studies (Monahan *et al.*, 2008; Parsons and Cobb, 2011) that VR immersive instruction might facilitate the learning of complex concept. How VR aids conceptual learning? One possible reason is that VR can provide enhanced visualizations into complex information, and its spatial proximity has an impact on learning. The other reason is that VR can simplify reality to the level of input stimuli. For example, college students practice observing skills through one-way mirror in a university-based childcare center (see Figure 1). Although the live observation could gain a sense of presence, there are many disturbing factors in the environment. Students may not be able to see the target child closely and clearly. Specific scaffolding is much more difficult to provide during the task. Figure 2 shows VR animation in this study, compared with live situation, the image is quite simple and clear. Questions for scaffolding are presented on the right side.

Figure 1. Onsite observation in preschool

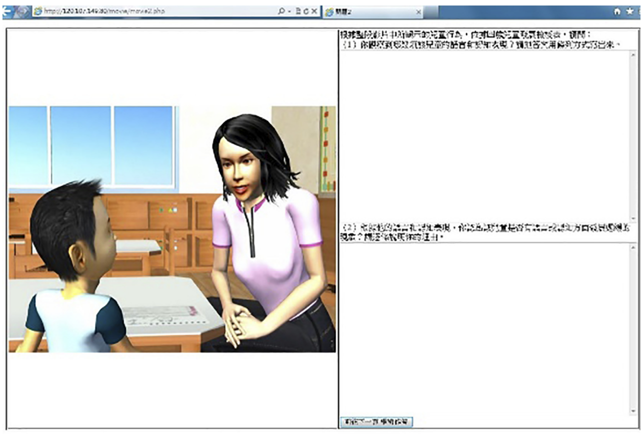

Figure 2. 3D VR scene and scaffolding questions

The research questions 3 and 4 try to investigate students' performance in context-free test items and in context-based test items. We explored the scores of three groups in different types of test items. Two kinds of test items were included in the delayed post-test: mechanical (context-free) and meaningful (context-based) questions. ANOVA analysis in Table 6 indicates that significant difference was only found in meaningful items. The sequence of scores from high to low is: 3D VR group, live video group and didactic group. Groups which provided visual stimulation got higher scores on meaningful questions. Hypothesis 3 was not supported but Hypothesis 4 was accepted.

Discussion

There are two major findings in the present study. First, the auxiliary learning of 3D VR is better than the real-life situation. Second, situational learning activities can improve the performance in context-based items. The present study found that well-organized 3D VR animation is more effective than live situation learning, especially for context-based task.

In the past, situational learning often emphasized engaging students in real entity context activities. The present study found that whether in the paper-and-pencil test or performance assessment, the 3D VR group showed better performance than the live video group. The possible reason for this result is that an authentic situation is like an ill-structured problem. There is too much information in the real world with some related to the target while others are not. The context of the live video group is very complicated and no certain rule can be followed. If teachers do not provide scaffolding to students at the appropriate times, students will find it hard to distinguish meaningful clues for judgment.

In fact, students in the live video group wrote down the greatest amount of reasons for their judgment compared to the other two groups. But unfortunately, parts of their observation were not key points for child development evaluation. Students seemed to digress in the ill-structured reality. This result is in line with Kapur and Kinzer (2009, 2007) and Kapur (2008). Inert knowledge of learners is a part of the semantic memory lacks autobiographical references when applied in the real-world problem solving (Kumar, 2010). It is difficult to recall inert knowledge without prodding questions.

Compared with the real-time situation, 3D VR animation, which is built on a digital learning platform, playback speed could be adjusted by the users. If the user cannot see the video clearly or wants to repeat it, the user can play backward or forward until they discern the events more clearly. Obviously, user needs to control the speed or replay features are not available in a real-time connection status. Learners can follow their own speed by pressing the mouse to control the video playback speed and frequency. These features assist students to follow the rhythm of individual differences in adjustment when watching the video. It should also help the 3D VR group obtain a higher rate of correct answers.

From the perspective of the cognitive load theory, it also supports the above opinion. If the animation is presented too fast and too complicated in the digital environment, the learner

Table 6. Results of two kinds of questions among the three groups

Question	Group	*M*	SD	*F*	*p*	post hoc
Mechanical questions	3D VR	25.96	5.22	0.59	0.554	
	Live video	26.77	3.57			
	Didactic teaching	26.00	3.67			
Meaningful questions	3D VR	25.04	4.88	15.19	0.000***	3D > Live video >Didactic
	Live video	22.87	4.17			
	Didactic teaching	20.21	3.11			

Note(s): ***$p < 0.001$

may temporarily not notice the changes occurring at the same time. Lack of sufficient time to organize and integrate messages influences the learning results. When learners can control their own learning materials rendering speed, it helps to reduce their memory load, and to avoid processing multiple message units simultaneously. If learners concentrate and spend more time on considering the content of learning materials, they should surely obtain a better understanding (Mayer *et al.*, 2003; Schwan and Riempp, 2004, Seeber, 2011).

The present study found no difference among the three groups in mechanical examination questions in the delayed post-test, but did in the meaningful examination questions. The scores of the 3D VR group and live video group were higher than those of the didactic teaching. It seems that learning activities include visual and auditory information which renders the task more pleasant, enjoyable and easy. Visual and auditory stimuli probably enhance the students' broad understanding of the practical situation and relationships within meaningful test item contexts which are referenced to their similarity to new circumstances. The function of context lies in establishing its linkage with students' perceptions and in promoting connections among knowledge, skill and milieu. Collins (1988) indicates that when students acquire knowledge in meaningful situations, lesson content becomes more transferable because the context provides support for its use. Authentic tasks like 3D VR assignment and live video connection involve practitioners engaging in real problem-solving practice; more experience might lead to higher scores in meaningful examination items.

Simulation learning has advantages over didactic and live-video approaches. Students can practice as many times as possible, but they cannot do the same thing in the live video. Simulation-based learning also provides an advantage to child care through the reduction of assessment errors compared to lecture style education. Situated simulation enhances practice and therefore may reduce the time taken to achieve competence. Multiple simulations of care, especially to children with special needs, are effective in improving pre-service teachers' confidence and competence related to child care practice.

Participation of VR simulation is an enjoyable experience for students. Situated learning courses involve activities in which learners engage in real problem-solving situations, rather than reproducing abstract knowledge. However, to avoid novices becoming lost in complicated real situations, well-organized simulation and proper scaffolding are effective. Simulation tasks are more likely to become self-referenced and purposefully engaged in by learners. Once novices have progressed in ability, they evolve their understanding of how to deploy their knowledge and skills in real situations. The findings of this study suggest that teachers can gradually arrange learning activities, from 3D VR to a real applied workplace; situated learning activities are more likely to support the transfer knowledge to real-life problem solving. Furthermore, VR also seemed to have a significant effect on student engagement, indicating that the groups pay more attention to the VR significantly more than the live video. The results deepen our understanding of how we learn with immersive technology, as well as suggest important implications for implementing VR simulation in schools.

There are several limitations to the current study. First, the researcher only implemented situated VR animation in one course, so we agreed that this learning experiment in no way approximates the entire holistic learning process. We need to test the effect of immersive VR by examining different types of learning content. Second, in this quasi-experimental design study, it lacked a manipulation and randomization for participants grouping. Such design leads a threat to lacking internal validity.

A significant requirement for future research needs to obtain qualitative evidence related to the effectiveness of using VR animation. To further validate and triangulate the effect, data from different sources such as students' interviews should be conducted. This may help us to understand much more about the relevance between the participants' experience and feeling of learning outcomes. Moreover, additional unique characteristics of participants such as sensory and cognition affordance could also worth being explored in the further research.

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