Incorporating 3D-Virtual Reality into Language Learning

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Abstract
The study aims to explore changes in learning outcome after using virtual reality instruments as teaching materials for college English courses, specifically, how digital environment affects the performance and motivation among undergraduates. Virtual reality has been widely applied in education settings. Its interactive interfaces provide students with realistic experiences and simulated everyday situations in a three-dimensional context for more authentic practice. The study focuses on the effect of incorporating Second Life, a virtual reality system, into college English classes. A semi-experiment is conducted in which an experimental group is taught with Second Life system, while the control group receives conventional one-way lectures. Result of the study shows significant improvement in the group of first year students who were taught using virtual characters. In addition, using virtual reality as teaching aids greatly improves students’ performance and motivation. Both the process and the result of the study imply potential benefit in using virtual systems and characters to improve language pedagogy and learner’s motivation respectively. The study proposes that virtual reality be incorporated into advanced English courses as a way to provide contextualized language learning.

Keywords: virtual reality, avatar, second life

1. Introduction
Advances in information technology has propelled the vicissitudes of higher education, leading to a series of paradigm shifts in the concept of learning—from teacher-centered to learner-centered, from limited knowledge-based to multiple-context intelligence, from the confined classroom setting to learning without any geographic restrictions. This learning paradigm shift has seen significant transformations with the rise of the Internet and mobile devices. As a result, learner-centered e-learning concept steers curriculum design toward learning environment that stresses authenticity and interactivity[1], so that learners no longer simply assume the role of an observer or information receiver, but are able to take charge of their learning needs and participate in the learning process. Online virtual reality technology offers a mixture of the virtual world and reality to produce a simulated dynamic process, allowing learners to learn and interact, as well as foster autonomous self-directed and self-controlled learning.

Application of virtual reality has immense potential in language education, especially in the context of immersive and exploratory learning. Integrating virtual reality technology in language curriculum not only provides real-world-like audiovisual simulations, but also incorporates both the virtual and real-world learning environments for effective interaction, promoting learners’ interests and learning efficacy. Besides, game links derived from virtual scenarios and network resources permit learners to interact and learn with virtual characters, where this kind of game-based learning motivates and enhances the growth in language cognition. Second Life, a global platform now widely implemented in virtual language learning, presents a 3D virtual world that boasts practical virtual scenarios and learning materials in the creation of an immersive online learning environment.

Second life takes advantage of 3D animation technology to create a virtual reality environment, utilizing personified virtual characters as the carrier for users to interact within a virtual context, where real life can be simulated via virtual objects. For example, English learners can become an avatar in Second life, through which they can have authentic dialogues with native speakers [2], but also conduct language and cultural exchange or experience sharing with different virtual characters [3] [4]. Second Life has taken the limelight in language education, inspiring researchers and educators to explore how Second Life can be integrated into the existing curriculum to enhance learning effectiveness. Only a
few studies have provided empirical examples, but the pedagogy of incorporating 3D virtual reality and virtual characters from Second Life and possible curriculum integration have garnered research interests. Hence, this study will attempt to include Second Life virtual characters in college English curriculum, observe the benefits of this situational learning environment in terms of learning efficacy, and explore how virtual-reality-assisted learning materials can motivate autonomous learning.

2. Literature review

Virtual-reality-enhanced interactive learning environment brings together a mixture of virtual and real-life scenarios for a wide range of potential possibilities in teaching and learning, leading to follow-up studies or related applications on the feasibility of virtual reality in education[5]. From the perspective of language learning, augmented virtual reality simulations in real time and interactive learning environment give users a sense of immersion, thus increasing their interests and motivation in language learning. Currently, online learning and multimedia materials are included in the college English curriculum but to few good results. One of the most critical issues may be attributed to the lack of interactive materials, or inadequate realistic learning environment that may dampen motivation [6]. With this in mind, the integration of activities using the Second Life virtual reality platform into college English curriculum allows students to communicate in English through virtual characters, as well as engross in a scenario-based English learning environment, all of which can promote interactive learning and encourage learning willingness[7]. The following sections present the analysis and review of related literature to serve as the theoretical basis for this present study.

2.1 Situated cognitive learning

The concept of situated cognition was put forward by [8], which argues that knowledge exists in the context of learning and authentic situations, where the learner must take initiative in the interaction with the situation to obtain the knowledge of the context and to construct their own knowledge out of the context. In other words, knowledge is only present in the situation, from which learners must partake in the process and explore the materials in the context to truly understand the significance and usefulness of knowledge [9]. Curriculum design exploiting situated cognition comprises the application of learning resources and learning activities with emphasis on interactive participation and sharing, bringing learner’s involvement from the fringe to the center [10]. The notion of situated cognitive learning lies in authentic learning activities, real-life scenarios or immersive learning in simulated situations, which are built upon an interactive learning environment that allows learners to proactively construct their own knowledge.

As information technology and multimedia application continue to make headway, situational learning takes on a broader meaning. Lifelike multimedia effects and computer-simulated situations make it possible for the construction of either a real or virtual learning environment, or a combination of both, that can facilitate learning in a variety of situations. Harley [11] suggested that interactive online learning environment grants learners more autonomy that promotes the active exploration and motivation of knowledge construction. McLellan [12] further pointed out that virtual reality technology offers interactive virtual scenarios as a tool for immersive learning. Learners are given the chance to reflect on the materials and carry out discussions in the virtual reality environment, and incorporate what they have learned in the situations into their daily life, attaining a higher level of transfer of learning.

2.2 Pedagogical application of virtual reality

Virtual Reality, as its name implies, is a virtual simulated environment generated with use of computer technology, creating a make-believe virtual world that is close to real life. Virtual reality is more than just a hardware system [13]. It is a dynamic environment that is designed for users to have direct experience and communication, which acts as a new interface for users to interact with information [14]. In another word, virtual reality is a medium that overlaps cyberspace, the real world, and the user. The unique environment of virtual reality provides opportunities for actual proactive learning and interactions with the virtual environment, on top
of functioning as an adaptive learning approach for learners preferring to learn by feeling or doing. According to Bricken [15], integrating virtual reality in the learning process can help students learn from experiencing the context, where in between the real world and abstract logic is a natural interface that allows students to go beyond textbooks and develop more flexible and fitting learning strategies.

Virtual reality application in education has three features: real-time interactivity, strong immersion, and high imagination. The Linden Lab developed online virtual platform Second Life is an exemplary use of incorporating virtual environments and technology in learning. The construction of Second Life draws on the three features of virtual reality, which is teeming with interactivity, engineering the possibilities of interactions between individuals, between individuals and the community, and individual with virtual objects. At the same time, virtual role-playing avatars and life-like 3D environments present real-life scenarios and cultures for enhanced sense of immersion in the learning context. In addition, Second Life enables the visualization and contextualization of real-world objects or situations not readily accessible in real life, thereby fueling learners’ imagination. According Ritzema and Harris [16], Second Life simulated curriculum can help learners learn more effectively, where its dynamic and interactive features incentivize learners to participate in the learning process. The integration of Second Life virtual reality platform is undeniably an educational tool not to be overlooked.

2.3 Curriculum design for learning autonomy

The most essential element in autonomous learning is motivation, which does not usually come naturally, but must be guided by effective teaching. According to the ARCS Model of Motivational Design proposed by Keller [17], learner's motivation must be promoted and sustained by attention, relevance, confidence, and satisfaction, where together the four elements would motivate students to learn. For instance, English learning in non-native countries is often restrained by differences in language cognition and divergent cultural backgrounds, causing the inability to flexibly incorporate the English knowledge and culture into the curriculum to arouse students’ interests. In view of this, Brown [18] suggested that instructors can use technology resources to supplement course design, thereby encouraging students to learn English. To this end, the integration of Second Life in the curriculum is in line with the four elements in the ARCS Model of Motivational Design proposed to stimulate motivation, which not only rouses learner's attention on the content, but the virtual reality scenarios offer associations with objects familiar with the students. Moreover, through interactions with other avatars, students can establish a sense of self-confidence and achievement, attaining the objective of autonomous learning.

3. Research methods

The present study adopted a quasi-experimental design to analyze the impact of integrating virtual-reality as supplementary materials in a college English course, and its effects on autonomous learning motivation and English learning achievements. The test subjects consisted of first-year college students taking an English course, who were further divided into experimental and control groups, with learning mechanism as the independent variable. The experimental group was subjected to learning based on situated cognition, in which Second Life online learning platform was utilized to incorporate virtual characters into the materials. On the other hand, the control group was subjected to traditional lecture-based learning using the same materials as their counterparts. The two dependent variables in this study were learning achievement and autonomous learning motivation.

3.1 Test subjects

First-year undergraduate students were the test subjects for this study, coming from two classes in the English department at which the researchers teach. The two classes in this convenience sample were randomly assigned, respectively, to be the experimental group incorporating online virtual characters, or the control group receiving traditional lectures. Each class comprised 34 students, and was taught by the same instructor to avoid additional variables from affecting the results.

3.2 Research tools

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In order to understand the effects of incorporating virtual characters in English class on first-year college students’ learning achievement and autonomous learning motivation, this study adopted a quasi-experimental design for data collection and analysis. Research tools can be divided into three parts: autonomous learning motivation scale, English language achievement test, questionnaire for virtual-reality-assisted learning. The autonomous learning motivation scale was based on the Motivated Learning Strategies Questionnaire [19], and revised to measure autonomous learning for English. As for the English learning achievement test, College Student English Proficiency Test (CSEPT) was adopted for its high consistency, reliability and efficacy to objectively assess students’ English proficiency and learning achievement. The questionnaire was prepared in accordance with the objective of this study, aiming to understand students’ opinions on the integration of virtual reality materials in English courses, which can be of practical reference in further application of virtual reality in other curriculum.

3.3 The learning process

The curriculum for the present study was designed for freshman English, including vocabulary, grammar and reading comprehension, for the course of one semester. The materials used in either the experimental or control group were the same, except for the supplemented application of interactive online virtual characters in the experimental group. Second Life virtual reality platform was used for the generation of interactive avatars, as shown in Figure 1.

Learning activities for the incorporation of virtual characters were founded upon Keller's ARCS Model of Motivational Design to include four elements: attention, relevance, confidence, and satisfaction. Here, the four elements were revised to construct the major steps in the learning activities. First, freshman English materials were imported into Second Life virtual reality environment to draw the attention of students; then, interactions with virtual characters allowed students to immerse into an English learning environment, where they would gain more confidence and a sense of achievement through scenario associations in the virtual reality, ultimately reaching the objective of autonomous learning. The design framework for the integration of virtual characters in the English learning materials is presented in Figure 2.
4. Results and discussions

The data in this study were subjected to analysis by SPSS statistical software. Since the experiment was conducted using class as a unit, individual test subjects cannot be randomly sampled for the sake of data integrity. Hence, students’ grades in English class of the previously semester were considered the covariance, the pedagogy the independent variable, and the English learning achievement test the dependent variable; analysis of covariance was performed to observe the differences in the two groups.

4.1 Effects of integrating virtual-reality avatars on English learning effectiveness

The results showed that, in terms of learning achievement, students having avatars into the learning materials outperformed their counterparts receiving only conventional lectures. As shown in Table 1, significant difference was observed between the two groups in all three categories, i.e. vocabulary, grammar, and reading comprehension. In line with the situated cognition theory proposed by McLellan [12], this finding demonstrated that students in the experimental group were granted the opportunity to interact with other avatars under different situations in the virtual reality environment, meaning they gained actual practice, hence the improved learning achievement. In contrast, students in the control group received less environmental stimuli and interaction opportunities, leading to significantly inferior learning achievement in terms of vocabulary usage and reading comprehension.

<table>
<thead>
<tr>
<th></th>
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<th>Control (N=34) Mean</th>
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<tr>
<td>Vocabulary</td>
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<td>4.385</td>
<td>6.269</td>
<td>.015*</td>
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<tr>
<td>Grammar</td>
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<td>6.999</td>
<td>8.843</td>
<td>.004*</td>
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<td>4.332</td>
<td>.041*</td>
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<tr>
<td>comprehension</td>
<td></td>
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*p < .05

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Figure 2 Framework for the integration of virtual characters in English learning materials
4.2 Effects of integrating virtual-reality avatars on autonomous learning motivation

The results found significant differences between the two groups on the autonomous learning motivation scale. As presented in Table 2, digital materials with avatars were proven to attract students’ attention, leading to higher willingness to participate in class, and higher motivation for autonomous learning. This finding was similar to the argument put forth by Ferrington and Loge [20], in which students play a more active role in the virtual reality learning environment to bring their personal capacity into full play, attributing to improved autonomous learning.

<table>
<thead>
<tr>
<th></th>
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<th>Control (N=34) Mean</th>
<th>t</th>
<th>P</th>
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<tr>
<td>Intrinsic goal-oriented</td>
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<td>11.50</td>
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<td>.037*</td>
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<tr>
<td>Extrinsic goal-oriented</td>
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<td>16.82</td>
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<td>Recognition of learning value</td>
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<td>Learning self-efficacy</td>
<td>12.29</td>
<td>11.06</td>
<td>2.109</td>
<td>.039*</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01 ***p < .001

5. Conclusions and suggestions

This study utilized virtual reality tools to supplement English learning for college students, employing Second Life as a platform for building an immersive English learning environment. Virtual characters in Second Life were integrated into the curriculum for exploring the effects of the incorporation of virtual reality digital materials on students’ English learning effectiveness and autonomous learning motivation. Based on the findings, integration of avatars in the learning materials can improve English learning efficacy, as the use of virtual reality materials was proven to be significantly better than using solely conventional English materials. Meanwhile, the finding also suggested that different materials have significant interaction with learning effectiveness.

As regards autonomous learning motivation, virtual reality digital materials provided enhanced interactions and simulated situations for real-life association, consequently promoting participation and encouraging autonomous learning. At the same time, the questionnaire showed that the majority of students held positive and affirmative attitude toward the integration of avatars in learning English, averaging at 4.5 on a scale of 5. In conclusion, the application of virtual reality in English learning materials has significant benefits in improving the learning autonomy and effectiveness. In the future, college English curriculum design should try to incorporate virtual reality tools to create situation-based English learning environment, and introduce the concept of cooperative learning to facilitate peer interaction and exchanges.

6. References

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