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# **Second Life for Dental Education**

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*Abstract:* Dental education strives to balance the use of traditional teaching methods with technologically advanced systems to meet the needs of an ever-expanding curriculum. Establishing distance education technologies is an identified goal of dental education. Technologically adept students desire meaningful and efficient distance education instruction. A majority of preclinical instruction is devoted to acquiring psychomotor skills and methods of patient care delivery, and simulation is a pedagogical instructional tool used for acquisition of preclinical skills. The purpose of this article is to review the technological tool *Second Life* as a medium for total virtual patient simulation. *Second Life* demonstrates promise for enhancing current standardized instruction and competency testing and for promoting distance education. As an emerging technological tool, *Second Life* is valuable as an adjunct to preclinical teaching methods in virtual problem-solving and communication prior to student clinicians' treating patients in the clinical setting and as a resource for continuing dental education for practitioners. Because some degree of consistency exists in the curriculum objectives of preclinical patient care and assessment in dental and dental hygiene education, within the context of this article the term "dental education" refers to both professions of dentistry and dental hygiene.

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Dental education has been assessing the value of distance education<sup>1</sup> and the steps required to deliver technology-based learning while providing high-quality patient care teaching methods for dental and dental hygiene students. *Second Life* (SL)<sup>2</sup> is a three-dimensional technology that provides simulation-based virtual settings. Dental education has used simulation since the 1990s for training and development of psychomotor skills. Activities in SL provide a way to combine new simulation technologies with role-plays to enhance instruction in diagnosis and treatment planning. Case studies and role-plays have been used as effective evaluation mechanisms to foster decision-making and problem-solving strategies in the delivery of patient care. One may consider what additional value SL adds to the curriculum. As the use of SL in dental education is newly emerging, there is limited research to prove its merits; however, the literature suggests that existing educational practices may be enhanced by its use.

Providing an overview of dental programs' emerging designs will present some of the immersive environments in which multiple students and faculty members interact. In addition, student clinicians need the educational preparation to deliver care to populations that are not only living longer but doing so with a host of chronic diseases. Students have,

at times, limited access to treat diverse populations while in the dental school environment. It is educators' responsibility to better prepare future clinicians, and SL offers ways to virtually encounter clinical scenarios. Synchronous distance communication is a reality in SL activities, which can foster resource sharing and collaboration, thus promoting globalization of dental education. Donaldson et al.<sup>3</sup> forecast globalization of dental education, which improves access to quality dental care worldwide. In addition, SL offers distance education resources that are easy and convenient for dental professionals to connect globally and collaborate with other professionals.

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## **Description of *Second Life***

SL offers engaging three-dimensional environments that mimic real life. An individual logs on and follows the instructions for creating custom-designed avatars to transport and transfix one's attention to the anytime and anyplace atmosphere that Linden Labs has created.<sup>2</sup> Avatars interact on public land or in islands that can be produced for educational purposes that are closed to the public, thereby ensuring a more secure, private environment fabricated for a particular audience. The 2007 Horizon Report of the

New Media Consortium's Emerging Technologies Initiative's panel of experts<sup>4</sup> expected virtual worlds to become a common trend within several years, and millions of users have made this prediction a reality. If learning occurs during role-playing and simulation in virtual worlds, then dental education should begin to address how SL can initiate advances in curriculum and distance education technologies. In a review of health care learning environments, Hansen<sup>5</sup> found that the use of virtual 3-D technologies eased student anxiety, improved cooperation and collaboration, and supported conflict resolution when students interact with patients and other health care professionals' avatars.

Some institutions of higher education are posting their recent advances in SL on the Internet. Linden Labs offers educational institutions a reduced start-up and monthly maintenance fee to counteract the expense it may take to establish land in SL. The University of Maryland's virtual dental school website<sup>6</sup> has three floors that mimic the actual building design, including a lecture hall to accommodate seventy avatars and multiple clinical dental chairs. Within the SL environment there are limitless opportunities to enrich the distance education curriculum. The innovative dental hygiene department has created preset clinical infection control technique scenarios. A review class was conducted by an avatar whose creator/instructor was home recuperating from back surgery. Plans are being made for an anatomy practicum using virtual skulls, and dental faculty members developed nervous and hostile virtual patients to challenge students' problem-solving skills. With voice-enabling capacity and the use of headphones and microphones, a participant has the opportunity to hear other avatars in the learning environment. There are limitless other uses that could be developed. Guest lecturers can be invited, visiting faculty members can tour other institutions' islands to promote new innovations, faculty and student dental/dental hygiene associations can meet, and students can collaborate with other dental students or students studying in other health disciplines from within their own universities or from around the globe.

Dental school programs that publish their activities in virtual worlds demonstrate common uses of SL being evaluated. These include standardized methods of evaluation for accreditation purposes, communication skills, exposure to elaborate health issues, future standardized national testing methods, and access to educational materials. Another applicable trend is SL's purpose in teaching problem-solving issues

for patients with high-risk medical issues. Using virtual SL patients with uncommon health ailments, the faculty at the University of Southern California School of Dentistry exposes students to exercises in diagnosing complicated problems, which in turn eliminates the use of live patients in a risky environment.<sup>7</sup> SL is especially useful during the first half of the curriculum when students are inexperienced in patient care. In addition to problem-solving, studies at Case School of Dental Medicine are now being conducted on SL's usefulness in assessing students' abilities to communicate with their patients on such things as tobacco cessation; in addition, competencies can be assessed "in a convenient, standardized and cost-effective situation."<sup>8</sup> The International Virtual Dental School (IVIDENT) was created by King's College London Dental Institute to become a repository for globally distributed online dental education.<sup>9</sup> Because SL is a three-dimensional global network, it is being used collaboratively for educational research between IVIDENT and the University of Michigan School of Dentistry's SL environment called Wolverine Island. Wolverine Island was developed by the medical school of the University of Michigan, and is a prime example of an environment that has emerged to work globally as well as in interdisciplinary areas of its own university.

The key to success in experimenting with SL includes institutions' cooperation to coordinate faculty members who are willing to take on new instructional challenges. Barriers to implementation of distance learning strategies include lack of instructional design and faculty development programs.<sup>1</sup> Commitment from instructional technology departments to train the faculty is another key to success in SL.

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## Application to Simulation

Students must be physically present for psychomotor skills training. However, simulation is the area where dentistry is routinely using new technology to enhance learning. Simulation has been used to teach clinical decision making as well as technical procedures. While current simulation techniques are not routinely part of distance education, an understanding of current methods enhances knowledge of where distance simulation and virtual environments' paths may cross in the future. When dental students at Case School of Dental Medicine were exposed to a virtual reality, computer-assisted simulation system, less faculty instructional time was needed than for

the non-computer-assisted simulation.<sup>10</sup> Students' participation was found to be more efficient, less faculty time was required, and the virtual reality version provided a non-subjective, self-training format that can be used independently at a student's discretion.

DentSim is another example of virtual reality-based technology that has been used in the United States and the United Kingdom. DentSim is three-dimensional and gives feedback in real time. Buchanan<sup>11</sup> at the University of Pennsylvania School of Dental Medicine followed five years of virtual reality-based technology (VRBT) with students, reporting that VRBT was conducive to more self-evaluation and feedback, making the investment in the technology worthwhile for enhancing education. Innovative haptic technology utilizes gloves or "jigs" to provide a sense of touch and allows users to feel tactile stimulation while using a virtual dental instrument on a model. At the same time, the operator watches an image of the oral cavity on a computer screen with 3-D graphics. PerioSim is an example of a haptic technology program that uses a specific instrument called a periodontal probe. In a study by Steinberg et al. at the University of Illinois at Chicago College of Dentistry, using PerioSim resulted in interesting findings regarding faculty.<sup>12</sup> Minimal training time was necessary, faculty age was not a barrier to success with the technology, and being computer-friendly was not a prerequisite for ease of use of the instrument. This technology brings us one step closer to the possibility of a fully computerized model of the total virtual patient avatar that can respond to tactile stimulation and provide instantaneous patient feedback to the operator on how the technique feels. SL has the potential to greatly enhance current methodologies, eliminating some of the need for new design.

Haptic technology is not new to dentistry. A correlation can be drawn between dentistry and nursing in the use of haptic technology and the addition of SL. Hansen<sup>5</sup> agrees that while SL may not nullify the need for haptic simulation mannequins in nursing education for advanced cardiac life support, it may serve as a supplemental tool for learning. A positive aspect of simulation is that it is available for students to practice to the extent they desire. Just as the mannequins in the preclinical environment are open to self-directed practice, the addition of computerized virtual reality patient simulation will afford access to practice at students' convenience. It is significant to note that these studies show positive results in challenges mentioned previously on faculty

time and comfort with technology. Experience with new technology takes time for adaptation, and SL's learning curve is no exception.

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## Patient Care in Preclinical Education

Preclinical teaching and learning take up a majority of classroom and laboratory time in the first half of the dental curriculum as students prepare for entering clinical treatment areas. Students desire less seat time in the classroom. Dental hygiene students who are engaged in face-to-face instruction request more blended learning instruction similar to that available to distance education students. Faculty members use calibration mechanisms so that assessments on medical histories, chief complaints, and assessments of present oral diseases are standardized with as little subjectivity as possible during the exercises. Teaching patients how to modify or establish new oral health behaviors can also be accomplished with virtual patients in SL. Student clinician/patient role-play, which has historically been conducted in class between students, can now be used in the SL dental clinic with audio and video. Students express limitations and are self-conscious about how well they can mimic the part of the patient in a role-play. Avatars representing patients can be personalized and mediated by instructors, thus giving students' avatars more opportunity to focus on their role as the practitioners.

Dental education uses competency-based educational approaches in both preclinical and clinical evaluations. Students' skills and behaviors are measured and expected to meet a specified level of competence in order to establish eligibility to take written and clinical standardized national board exams. The members of the Task Force on Student Outcomes Assessment of the American Dental Education Association's Commission on Change and Innovation in Dental Education was given the task of identifying changes in the curriculum to ensure competence. Kramer et al.<sup>13</sup> found that virtual reality and computer-based clinical scenarios are "highly accurate and potentially useful assessment tools" for diagnosing, managing, and treatment planning anomalies such as trauma, pain, periodontal diseases, and caries as examples.

There are specific patient populations that students lack exposure to in the preclinical environment. These include persons with physical or developmental

disabilities, language barriers, psychosocial behaviors, pediatric and adolescent management cases, and geriatric patients with age-related issues. Students must pass competency exams on real patients as well, but how do they prepare for the real thing? They rely on didactic materials and exams that have limitations for reality. Various virtual patient models have been developed and show some positive outcomes in their use. Boynton et al.<sup>14</sup> found that predoctoral dental students exposed to a simulated exercise for pediatric behavior management outperformed the control group on a standard exam and reported positive feedback. Even more significant was the fact that the exam results were the same for students exposed to the virtual simulation as students who treated pediatric patients for six days in a clinical rotation. Another example of a virtual model is a proprietary program called Sitemaker, which is a website created to represent a virtual child. Two hundred pages of web text were developed to direct students to synthesize information and pick appropriate responses to the reaction of the patient. An exercise of this type could be further enhanced by voice and expression which an SL-developed avatar could easily provide. Using alternative technology, a multimedia CD-ROM was developed by Kleinert et al.<sup>15</sup> that simulated a patient with Down syndrome. The authors believe the instruction to be valuable if the opportunity for real patient interaction is not available; however, the media selected cannot be used easily for a broad audience unless distributed on a large scale. Case studies for dentistry were developed by Abbey,<sup>16</sup> who claims that faculty members with little to no technical knowledge can use an Authorware template to make interactive case studies that are accessible and interactive. While the cases afford the same opportunity to problem-solve and make decisions, they are conducted on a CD-ROM/PC format, which has sensory limitations and lacks further dimension compared to what can be afforded through SL cases. These exercises can be expensive to produce and become redundant and outdated quickly. SL can be used in a flexible standardized format and made available to a wider audience used anytime or anywhere a laptop is available, without additional development, training, and hardware. Start-up costs are potential downsides to SL. The expense of developing an SL website may not be as great as duplication of effort if SL is conducted for a large-scale audience. *Second Life* may have considerable start-up costs but may be more cost-effective than redesigning highly technical virtual learning tools every time the need arises.<sup>17</sup>

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## Serving the Community at Large

Additional SL developments may potentially fulfill the needs of the distance online community of dental patients. Similar to the establishment of a Second Health virtual hospital for online health care communication,<sup>18</sup> dentistry can offer the public a chance to interact with one another to obtain information about dental health issues. Patients with dental phobias locate the source of their dental phobia and find relief for their anxiety by engaging in virtual exposure therapy within the safety of the virtual dental clinic. The dentist/student can accompany patients through the site.

Treatment-planning many complicated procedures at chairside can be very intimidating to patients as well as student clinicians. Having the availability to view dental procedures through multimedia will assist patients in their understanding and acceptance of proposed treatment. Gorini et al.<sup>19</sup> found an emergent role for SL in mental health communities in online eHealth areas. Certainly, an online eDentistry or eDental care site can be established to give support to patients in any area of dentistry.

Skeptics of SL may claim there is already a vehicle for distance technology to share dental information in the form of teledentistry. Teledentistry's mission is to give patients access to care in rural areas by sharing patient digital information with specialists and other health practitioners. Although teledentistry has been proposed for dental education, there are extensive limitations to its use regarding insurance coverage, licensure, malpractice, and privacy since real patient data may be misdiagnosed due to medical error or lost through transmission of data.<sup>20</sup> Teledentistry may be more applicable to private practices, but SL virtual patient transmission of information will ensure the integrity of real patients' information while still affording limitless opportunities with patient cases.

Mandatory continuing dental education for relicensure makes allowance for half of the total number of credits to be obtained online. The online global nature of SL will serve as an abundant resource of distance education courses. Licensed practitioners can utilize SL virtual worlds to access communities of practitioners who can meet formally or informally to share best practices and act as a resource for practical materials and advice.

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## Conclusions

Dental schools will globalize dental education. Students at large centralized campuses will follow trends and demand more blended learning opportunities due to their familiarity with online instruction and increase in student workload. Future trends will see dental schools developing as educational centers that will be responsible for establishing the technological means to deliver content over distances and include expanded off-site community-based clinical centers. This is happening within Maryland. The University of Maryland Baltimore College of Dental Surgery has opened two satellite rural campuses in Somerset and Cecil counties in addition to offering didactic curriculum online. Obviously, no tool or delivery system is a panacea. The strengths of *Second Life* are mainly that it is more cost-effective in building many simulations, offers capabilities for real-time role-playing, and, within these areas, provides a way to creatively explore critical thinking.

*Second Life* enhances learning by immersing its participants from any campus or computer in standardized simulation and role-playing technology. New graduates will easily integrate what they have learned in school with dental office technology in private practice, hospital-based and long-term dental clinics, and advanced dental specialties. In addition, *Second Life* fosters an area for collaboration of virtual communities of innovators in education from around the world.<sup>21</sup> Dental practitioners will reap the benefits of being able to access and become comfortable with *Second Life* like its millions of users across the globe, while taking part in a profession that is constantly evolving and sharing innovations.

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