

Evaluating Social Learning in a Virtual Environment via Concept Maps

Xin Bai

York College of the City University of New York, New York, USA
Email: xbai@york.cuny.edu

Joanne Lavin

School of Professional Studies of the City University of New York, New York, USA
Email: Joanne.lavin@cuny.edu

Abstract—Concept maps are often used as media for constructive learning activities. We evaluated student social learning outcome in a virtual learning environment via concept maps. Nursing students first follow a case study of a stroke patient, whose diet and life style eventually resulted in a trip to emergency room for stroke diagnosis and treatment in the virtual hospital. They were then given a new scenario and got on a virtual trip in Second Life, a Multiuser Virtual Environment (MUVE). They played the roles of a patient, a relative, a doctor, or a nurse, experiencing the emotional, physical, or social impacts those stakeholders may have gone through. Our study indicates concept mapping can be a unique and effective tool for measuring student social learning in a virtual environment.

Index Terms—concept maps, simulation, educational technology, role-playing, social learning

I. INTRODUCTION

Cognition involves processing of knowledge representations. Acquiring knowledge from students is crucial in determining what they know. A concept map is represented by labeled entities denoting concepts as well as links denoting relations among concepts. Thus it can be used as an assessment tool externalizing what students know. The entities in concept maps can represent facts, ideas, or blocks of content; while the relations can include hierarchical relations, propositional relations, and causal relations. For example, the student can define that Fish are animals; Fish can swim; Plants increase fish.

Bandura (1977) states behavior is learned from the environment through the process of observational learning. Social learn theories stress that learning is a cognitive process that takes place in a social context [1]. In recent years, virtual learning environments have been explored and evaluated by researchers to determine whether they can serve as an effective social platform that allows students to observe how people behave in various ways under various conditions. [2]-[4]. Such development is due to the advances and affordance of technologies, as well as continued recognition that embodied cognitive experiences and multimodal representation of knowledge and skills enhance learning

[5], [6]. For instance, it is usually not practical or possible to situate students in a real life setting due to the constraints of costs, space, or risks in a traditional classroom. More research is needed to harness the advances of technologies in order to provide our students with a meaningful learning context similar to real life.

This paper investigates the use of concept mapping as tools to assess social learning in virtual field trips. The following questions guide this research: How do students learn via virtual collaboration in virtual trips?

II. BACKGROUND

A. Social Learning in a Virtual Environment

Simulation-based training, as a kind of serious games, is a method of education that is ideal for addressing cognitive and technical skills as well as behavioral skills. Classroom and campus lab simulations have been found to be an effective instructional strategy that can enhance graduates' transition from classroom to real-life practice, provide opportunities for students to analyze information, make clinical judgments, and respond as if working with actual patients [7]. Paige and Daley [8] suggest that simulation learning be viewed in a situated cognitive lens as a social activity incorporating the mind, the body, the activity, and the tools in a context that is complex and interactive. Educators believe that it is not until a student applies theory to a given problematic situation that true understanding materializes. Many organizations recommend the use of simulation especially for team building [8].

There is also an increasing body of evidence demonstrating self-efficacy of simulation use, most notably, an improvement in self-confidence among students. Many articles in the nursing literature identify the benefits of using various types of simulation to enhance self-confidence as well as skill performance [9], [10]. The results have led to this study, which focuses on what happened during a field trip and how students respond to such experiences.

B. Evaluation via Concept Mapping

In his book Unified Theories of Cognition (UTC), Newell (1990) advocated that researchers formulate

theories of cognition in the form of cognitive architectures. Such structures can be represented via concept maps, which are networks with nodes chained together through propositional, functional/causal, and system relations. Theories like propositional representations (Kintsch, 1988), scripts (Schank & Abelson 1977), and semantic networks (Collins & Loftus, 1975) are examples of using symbols to represent human cognitive knowledge in computing systems. Propositional networks and scripts are similar to concept maps in that they both represent knowledge structures and contents in a declarative way, originating from a model of Semantic Memory (Collins & Quillian, 1969). In this model, meaning is accessed through the mental activity of accessing and retrieving information from a semantic network. Once built in a user's cognitive structure, the declarative knowledge can be used as a framework for understanding and learning new knowledge (Black, 1992). As Novak (1984) stated, "Meaningful learning involves the assimilation of new concepts and propositions into existing cognitive structures." Concept maps may enhance learning when they are used to summarize information. There is a great deal of evidence that creating or studying summaries boosts recall of summarized ideas (Foos, 1995). Winn (1991) reviewed research suggesting that pre-attentive visual processing of diagrams, such as visual chunking of collocated objects, lends efficiencies that cannot be obtained from text. Thus concept maps can be used to represent a user's cognitive structure as an assessment tool.

III. METHOD

Second Life was adopted as our virtual platform to contextualize student social interactions via role-playing. A virtual clinic was set up that included ICU, wards, waiting area as well as such equipment as heart monitors, ultrasound machines, a CT scanner, sinks to wash hands, cabinets with medical instruments. We also built a residence house as a setting for the patient and relatives to role-play.

Scripts of a case study on the topic of Strokes (CVA) were first developed by researchers, who then designed assessment instruments based upon learning objectives. Each role was represented as an avatar controlled in Second Life by research students. The play was rehearsed and recorded. Next the raw videos were edited to a teaching vignette to be used in basic baccalaureate nursing curriculum as well as in acute care hospital settings for Registered Nurse (RN) continuing education. The case is about an older African woman who develops a stroke and follows her emergency admission through discharge. The woman has many of the risk factors for strokes. For instance, she did not consistently take her medications nor follow the recommended diet. The story guides students through the assessment and acute management of a stroke. Constant communication among the researchers and domain experts are established to achieve a better understanding of domain specific contents such as NIH/Glasgow Scales or t-PA. The NIH stroke scale (NIHSS) measures several aspects of brain

function, including consciousness, vision, sensation, movement, speech, and language. A certain number of points are given for each impairment uncovered during a focused neurological examination. For instance, in the exam the patient is asked to open/close eyes, lift a leg, open/close mouth, squeeze hand, read words/sentences or describe a picture.

Machinima was adopted as a technique that uses real-time 3D computer graphics rendering engines to create a movie. We used Camtasia, a screen-casting tool, to record the story played out in Second Life. Animated PowerPoint slides were added to the video to give additional information such as illustrating family trees or explaining dosage calculation. Scripts were attached to some of virtual objects that functioned as action triggers. For instance, touching a question or picture on an NIHSS poster will allow nurses to hear a patient's response to that question or picture. Some customized actions, such as facial droop or sweating, were saved to a pre-designed action library so that users can execute them from a dropdown list. However, users need training to learn how to execute these actions. There is currently no intuitive way to execute these actions.

A. Participants and Procedures

We recruited twenty undergraduate Nursing students at an urban public university in New York. They were randomly assigned to one of four groups. After signing a consent form, they took a pre-test for prior knowledge, followed by a brief orientation by a researcher on the target topic. The orientation covered procedures a nurse needs to learn including the types of biological/chemical contamination, therapeutic management, and management of community panic. Then Group 1 & 2 read a case in traditional text; Group 3& 4 watched the same case in video format. All the groups then completed Question Set A. Next, they were asked to role-play via text-chatting online (Group 1 & 3) or 3D simulation online (Group 2 & 4) to address another complex inter-professional problem. Afterwards, they worked on Question Set B including a concept map (Fig. 1).

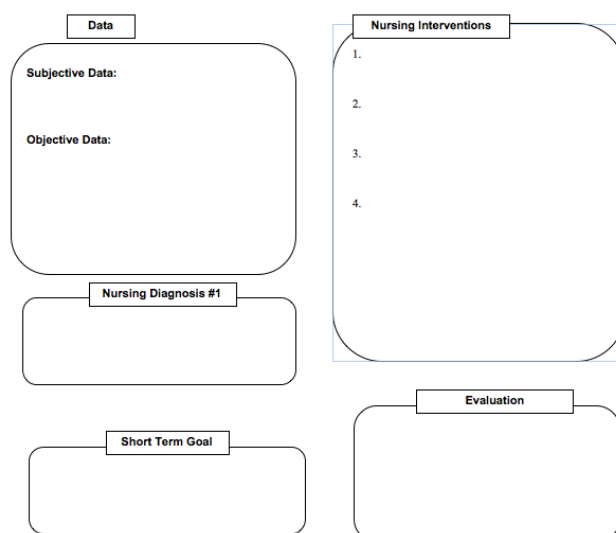


Figure 1. A concept mapping template as part of the post-test

B. Concept Mapping Data Analysis

The study is comprised of four conditions created by crossing the two factors of Case Study (CS) and Role-Play (RP). Each factor has two levels: text vs. simulation. For the CS factor, students either read a text-based case or watch a simulation-based video case; for the RP factor, students role-play either via text chatting online or in a simulated virtual environment.

We examined the social aspect of the learning behavior to obtain an insight into social cognitive learning via concept mapping analysis. Four outcome criteria were used: Nursing Diagnosis, Outcome/goals, Intervention, and Complete concept maps (Fig. 2). This has been a standard evaluation instrument that has been used in the Nursing department. One point was given to each correct response.

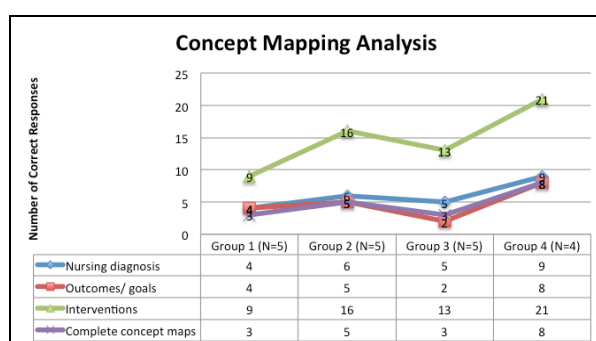


Figure 2. Concept mapping results

IV. RESULTS AND DISCUSSION

Pre and posttests result shows there is no significant main effect of the treatment among four groups. However, the concept mapping analysis result shows that the visual/visual group (Group 4) gained significantly the most. The correct number of responses more than doubled than those from the rest of the 3 groups in all the categories. This shows concept mapping, as an assessment tool, is able to measure student learning in a different perspective than traditional multiple-choice questions. What makes the difference? Is concept mapping measuring what we intend to evaluate? What kind of learning skills is being measured?

The concept map in the study provided a structure for the students to expose their mental model of the real life world: what happened, what could have been the cause, what can be done about it, how to achieve it, how to measure the outcome to achieve the goals. This format is closer to the practice in the real world, where similar health record is created as a medium to communicate patient health information, medical goals, diagnosis, intervention, and evaluation plans with other stakeholders, such as doctors and patient. In addition to communication skills, concept mapping can measure clinical reasoning skills, organization and planning skills, and problem solving skills. Such an approach is consistent with the constructivism beliefs that learners construct their own understanding and knowledge of the

world, through experiencing things and reflecting on those experiences.

How can concept map be designed to effectively enhance learning? Give students real world problems that require them to collect data, process the information, and make sound decisions. Use “What questions to promotes a holistic view of the patient. Use “How” and “Why” questions to stimulate creativity by encouraging students to articulate thoughts, generate new ideas. Usually there is no definite answer to such open-ended questions. Give them opportunities to talk with different stakeholders to get a better picture of a problem during the role-play. For instance, they may also need to determine what to do based upon what they have already known and the new information they have got from their peers. The teachers need to closely monitor the activities at this stage to ensure timely scaffolding for a more effective learning gain. Concept mapping is an effective way of assessing social learning in a real life professional environment.

V. LIMITATIONS

The case scenario itself may have stifled some student's responses and creativity in the study. They may have perceived that they needed to closely follow the script. It may be preferable to have a more open-ended scenario that presents a patient, relevant symptoms, and diagnostic test results, but allows the participants to freely determine the entire assessment, admission, and nursing intervention process.

Unfamiliarity with the virtual environment could be another limitation. Some students readily engaged while some others seemed hesitant initially. This may be a reflection of their age or previous experience with technology and/or gaming modalities.

Although the prior knowledge from both groups showed no significant difference via multiple-choice based questions, other forms of pretest should be considered for a more complete picture of students' prior knowledge. The content of the pre- post-test questions may not have effectively measured cognitive learning. Short answer questions may better reflect cognitive learning in such scenarios.

VI. CONCLUSIONS AND FUTURE DIRECTIONS

This study focuses on the effectiveness of using concept maps to understand and assess social behaviors in a virtual context and identifies strengths and weaknesses of such an approach to be used in a classroom. Our study indicates concept mapping can be a unique and effective tool for measuring student social learning in a virtual environment. Role-playing promotes communication, problem solving, clinical reasoning, and planning skills. Concept mapping allow instructors to embed meaningful questions in a well-designed structure that captures what students have gained in the social learning context. Further investigate is needed to explore the implications of promoting social learning via virtual

role-play as well as assessing the corresponding learning outcomes via concept mapping.

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Dr. Xin Bai is an associate professor of Educational Technology in Department of Teacher Education at York College, City University of New York. She earned her doctorate in Instructional Technology & Media from Teachers College at Columbia University. Her research focuses on educational games, simulations, intelligent tutoring systems, e-learning, and ubiquitous learning. Her work is built on the research done on cognitive science, artificial intelligence, and educational technologies.

Dr. Joanne Lavin RN, EdD, Board Certified Clinical Specialist in Psychiatric Mental Health Nursing, Professor. Professor Lavin is currently the Associate Director of the RN-BS Program at CUNY School of Professional Studies. Previously she was the Director of Nursing Programs at York College, CUNY. Professor Lavin also taught in Associate Degree Nursing for 25 years at Kingsborough Community College and was Chairperson for the last three years. Recent publications include: J. Lavin, "Obsessive compulsive disorder in children," *International Journal of Psychiatric Nursing*, vol. 1, no. 1, pp. 80–83, 2015. Professor Lavin has been involved in research using 3D simulations in nursing education.