

Integrating Web-Based Technology to Assist and Enhance Instruction, Assessment, and Application of Problem-Based Learning for Manual Therapy Techniques Used in Athletic Training and Sport Medicine

Todd Botto Ph.D., ATC
Physical Therapy/Athletic Training, Quinnipiac University
Hamden, Connecticut 06518, United States

Maureen Schorr M.P.H.
Instructional Technology, Quinnipiac University
Hamden, Connecticut 06518, United States

Joseph Daniel Lema Ph. D., FMP
Hospitality Management, Drexel University
Philadelphia, Pennsylvania 19104, United States

ABSTRACT

As students of the 21st century enter into higher education, faculty's pedagogical styles and delivery methods must evolve to address the rapidly changing needs and skills of the students and society. One such method is through the use of web-based course management delivery systems and interactive software.

Web-based interactive course management tools are relatively new educational phenomena. In the therapeutic and rehabilitative exercise curriculums this powerful new instrument may be utilized to enhance cognitive comprehension of basic theories, definitions, and applications. In addition, this web-based interactive tool may also function as a virtual assistant for the learning and mastery of various psychomotor skills necessary in the clinic. Incorporating and utilizing the various computer technologies, allows for the necessary foundational cognitive building outside the traditional classroom while creating a more inclusive environment inside the classroom for a deeper and richer problem-based learning exercise. In the rehabilitation settings it is not only important that the student understands the material but that they also develop the necessary critical thinking skills for appropriate application of the theoretical knowledge. It has been shown that incorporating problem-based learning into a curriculum is an effective way to improve an individual's critical thinking skills. In the model careful planning and implementation was needed to develop an interactive web-based instrument that serves all students in the class regardless of their learning style or rate of comprehension.

KeyWords: Interactive tutorials, Problem-Based Learning, Manual therapy, Athletic Training

INTRODUCTION

The application of pedagogical theories has long been a debate within educational hierarchy. The question as to which is the best method and how one educational approach over another is best delivered in the classrooms of higher education has been at the forefront of many formal and informal discussions. As a result, many instructors struggle to find the right integration of delivering course content, assessing the information provided and attempting to incorporate current technological innovations that are rapidly becoming available.

In the healthcare professions, problem-based learning is an approach that has recently gained popularity and momentum based on favorable outcomes. Problem-based learning is often considered to be advantageous for students' development and comprehension of their critical thinking skills. The difficulty in incorporating problem-based learning is the need for a higher level of cognitive functioning coupled with a strong foundation of basic theoretical definitions. Creating an environment that fosters critical thinking while meeting the demands of cognitive information supported or enhanced by the instruction of psychomotor skills may compromise the necessary time and attention needed to meet all the requirements of an academic program. The challenge to find an appropriate balance between cognitive information and stimulating critical inquiry within a course while providing an atmosphere which is conducive to all students within a program may seem like a daunting task.

In regards to healthcare curriculums, students have the opportunity to learn a host of cognitive and psychomotor skills, and are expected to become proficient in these areas. However, simple demonstration of these skills often proves to be insufficient. Students must couple these demonstrations with a comprehensive understanding of the theory, proficient performance of the skill, and application of the two with a critical decision (i.e., is it appropriate to use this skill in this situation?). These last two components, skill acquisition and critical decision making, are a constant battle for the healthcare educator. The healthcare educator has a variety of challenges to recognize and address such as the issue of how students learn at various rates, how students possess a variety of learning styles, or how to adapt to class sizes that are not conducive to provide each student enough one-on-one instruction. Often mastery of psychomotor skills demand a large amount of time and attention leaving less time to develop the necessary problem solving and critical thinking skills. When these situations occur, the instructor must decide to both move on and leave some students behind, or continue with the current topic until all students have mastered the hierarchy of learning. Neither choice is ideal. In one, the class progresses before some students understand the material, setting these students up for future difficulties. In the latter, lack of interest may ensure for those that have mastered the information, or the remainder of the semester could be

jeopardized for the instructor. As a result the utilization of a enhancing the course content being delivered in addition to serving as a virtual assessment for cognitive as well as critical thinking skill development.

However, for better utilization of this relatively new educational phenomenon several basic educational theories and application require further examination. The comprehension of how students learn will better serve as a foundation when designing and incorporating any course content delivery system to aid in the enhancement of the educational environment.

THEORETICAL FOUNDATION

Upon examination of various educational theories, several points of view as well as educational research was considered when developing the model. The following model builds a virtual assistant utilizing three main educational theories.

Bloom's Taxonomy

As an educator one will recognize that there is more than one type of learning that takes place both inside and outside the traditional classroom setting. In 1956, a committee of colleague's led by Benjamin Bloom identified three specific domains of educational activities. Bloom's domains include cognitive, affective, and psychomotor development [1].

Cognitive is for mental skills or knowledge, affective is for growth in the feelings and emotional areas or otherwise attitude while the psychomotor domain is designated for the manual or physical skills [1]. These three categories outline the goals of teaching for someone who implements Bloom's Taxonomy. This compass for instruction can be evaluated at the end of an exam or course to verify if the student has acquired these new skills, knowledge and attitudes, and if the course objectives are being met. Some accrediting governing bodies for various healthcare curriculums base their educational standards and guidelines based on Bloom's Taxonomy model. Furthermore, this specific outline has been integrated into classroom activities and structure of the information provided to the students within this specific course.

Constructive Theory

The constructive theory is recognized as part of an educational component for use of this program. Constructivism refers to the idea that students construct knowledge for themselves based upon life experiences [2]. It refers to learning as both an active and reflexive process in which learners attempt to construct new ideas and concepts based upon past and current knowledge. Often the learner will select and transform information, construct various hypotheses, and make decision based on a cognitive structure [2]. As a result, the students will often be influenced or shaped by a particular subject before they enter the class.

Bruner states [2] that a theory of instruction should include four major areas: (1) a student's predisposition towards learning, (2) a way in which a body of knowledge is to be structured so that it can be most readily grasped by the student, (3) the most effective sequences in which to present the material, and (4) the nature and pace of rewards and punishments.

web-based interactive assistant is a creative aid used to assist in This challenge of pulling together this "melting pot" of social experiences which the students bring to class serves as a challenge for any instructor when considering ways to accommodate the individual levels and rates of comprehension of each student. While some students may have past experiences to draw upon, others may have limited experiences to serve as a resource. This imbalance of experiences creates a situation for which some students may progress more rapidly than others. This varying rate of progress serves as a potential concern for the instructor. As mentioned earlier, the dilemma to move ahead will leave some behind while the choice to remain until all are proficient may result in more advanced students becoming bored and less attentive.

As a result, working towards problem-based learning may create a challenge in any classroom when trying to incorporate a curriculum that will encompass and include all students and not serve towards one end of the learning spectrum or the other. However, even though these challenges do exist there are solutions and creative ways to incorporate and encourage active learning within the classroom. Creating a hybrid interactive on-line environment where part of the course is supported by virtual assistance and assessment aids in bridging the gap between the learning curves of the students.

Problem Based Learning

Problem-based learning (PBL) is a rapidly accepted and widespread instructional approach utilized by many programs in the healthcare fields within the United States. This popularity of pedagogical application has gained momentum over teacher-centered lecturing (TCL) for several reasons. One of the major reasons PBL has gained momentum over TCL is that with TCL much of the emphasis is on memorization as compared to a more critical thinking approach associated with PBL [5].

PBL is defined as "the learning that results from the process of working toward the understanding or resolution of a problem" [5]. Utilizing such an approach to learning, the students are engaged in solving problems and becoming active learners. Several authors have described the environment and tasks of the students in the learning process [3, 4]. These authors propose, furthermore, that students will work together in small groups to solve a problem assigned to them by their teacher. They must examine, internalize, and reason through the problem by defining and identifying the objectives. The group members are assigned specific tasks, spend independent time gathering information and reporting back to the group to review, process and summarize the information. During this culmination of information, students must examine each objective and their performance before they report back to their instructor. Upon completion of their project the instructor will provide final feedback [4]. An outline of this process is as follows:

- Identify the issues and define a common problem
- Frame the various objectives
- Outline and assign a work schedule
- Gather, analyze and interpret data
- Present and discuss learning findings related to objectives
- Summarize findings into potential solutions
- Evaluate performance

The application of the above learning centered theories is the foundation for the design of the on-line course content interactive virtual assistant. The content is used to enhance the comprehension of cognitive knowledge as well as provide an active tutorial for psychomotor skills necessary to succeed in the industry. Basic comprehension and psychomotor skills take valuable time in class to perform and become proficient. This tutorial will aid in easing the time constraints by allowing the student to work at his/her own pace while creating ample opportunities in the formal classroom setting to develop the critical thinking skills necessary for problem based learning.

DESIGN AND IMPLEMENTATION

Course Content Design

Building upon the basic pedagogical theories above, the instructor is now ready to begin building and implementing their instructional tools into their course. In the design and development of the course content and on-line teaching aids, the developer must keep in mind several key components (planning/designing, development and implementation, course and student evaluation, and revision and reintegration) which will support the development of their content.

Recognizing the hierarchy of learning progression is the first key step to building an interactive web-based tutorial found in the design or planning stage of the product. The developer needs to identify and determine the need for the product, the audience which will utilize the product, and establish the outcome goals of the tutorial. For instance, the developer needs to ask several key questions. Is there a specific need for the product and is this the best solution and approach for addressing such a need? Who is the audience and do they possess the capabilities to utilize the educational and technological tools available and benefit from their potential? Does the student have adequate access to the necessary technological tutorials for sufficient practice and review? Once these questions have been reviewed the proper choice for software and content delivery is now more appropriate.

The final component to complete the design stage is to establish clear, defined, and measurable goals for the student as well as the instructor. Self-testing and content review feedback is necessary for appropriate modifications to the instrument as well as a compass for student progression.

Once the design and planning stage is complete, the next step is to develop the course content material for the on-line tutorial. First the developer needs to examine their current material, explore any optional material on the market and determine the appropriate use and application for integration into their course materials. Second, the developer should organize and develop supporting course content as necessary. This process should be reviewed by an outside party and feedback should be provided as to the flow, clarity, ease of use, and functionality of the program. The final step in the development stage should incorporate selecting, developing, and finalizing the materials for selecting the appropriate course content delivery system. During this process the developer should keep in mind and locate available support and resources both inside and outside their institution. The development of course content management systems and software to support their projects continues to evolve at an unprecedented rate. Keeping current

with the development of new products may make the utilization and function of the product easier and more user friendly for both the instructor as well as the student.

The third major component necessary for developing the product is the need for establishing an evaluation method for both the student and course materials. The evaluation methods should include a review of the goals and objectives, a comprehensive evaluation method, and a system for collecting and analyzing the data. Immediate feedback is necessary to encourage student participation. In fact, Zirkin and Sumler [6] found that interaction seemed to have an impact on student achievement, as well as satisfaction: "The weight of evidence from the research reviewed was that increased student involvement by immediate interaction resulted in increased learning as reflected by test performance, grades, and student satisfaction"(p 97).

The final component is a strategy for revising the program which should include the development and implementation outline for future adjustments. Regular feedback from the user's of the program serves as a valuable tool for future modifications, improvements and revisions.

Manual Therapy Integration Model

This model incorporates an interactive software program delivered through a course management system. The web-based interactive tutorial was designed to allow for students to view cognitive material such as theories, definitions and various manual therapy application rules as well as indications and contraindications for using such modalities and techniques.

Once students familiarize themselves with the necessary content needed for a strong theoretical foundation, the student may then proceed to access a number of short video clips demonstrating a host of various techniques. The video clips have been divided by anatomical location making the access to a specific joint or technique easily to identify for quick access.

A third component of the tutorial is the ability to access a variety of quizzes allowing students to choose from basic cognitive questions and answers based on definitions, rules, indications, and contraindications provided in the overall introduction sections of the website. Students choose a quiz, complete the quiz, and receive immediate feedback at the end of each question as to why this is the correct or incorrect answer. Upon completion of the quiz, each student is also provided with a tabulation of results for each question. Students are free to take the exams as often as needed with their results automatically submitted to the instructor via email. The course management system allows for individual student monitoring by the instructor. As students gain confidence and begin to feel comfortable with their progress they may then choose from several other quizzes. Each of these quizzes are designed to progress in level of difficulty that slowly moves away from straight forward memorization of definitions and theories to more thought provoking application, critical thinking, and problem solving content. This progression of assessment serves as a foundational tool for problem-based learning activities, discussion, and debates within the traditional classroom.

The design and intent of the web-site is to set a foundation which will allow for a more efficient use of time in the classroom as well as provide an extra resource to accommodate all students and their individual comprehension rates neither catering toward one extreme nor the other in the classroom.

Time in the classroom may now be utilized to create an environment of discussion and hypothetical situations for creative group participation on the appropriate outline of therapeutic exercise programs for a host of injuries which are provided by the instructor.

CONCLUSION

This hybrid approach and implementation of a web-based interactive virtual assistant has created an environment supporting the various learning styles and rates of all students within the class. The use of video as well as theoretical information has provided ample opportunities and an environment for each student to customize their learning. Taking into account that learning is an active and reflexive process, this tutorial allows students to revisit the program as often as they wish while gradually building and developing the skills necessary for the successful adaptation and implementation of the current topic. This freedom and active engagement enhances the learning environment by creating a stronger foundation for problem-based learning both inside and outside the traditional classroom setting. The strength of the program is the immediate feedback from the tutorials and the short step by step video clips which help the students become more proficient with their skills. If the student needs assistance, the area for improvement has been identified and narrowed allowing for customized instruction from the instructor gaining valuable time for specific problems as opposed to fishing around with the student to identify problem areas.

REFERENCES

- [1] Bloom, B. S., Mesia, B. B., Krathwohl, D. R., (1964). **Taxonomy of educational objectives** (two vols: The affective domain & the cognitive domain.) New York.
- [2] Bruner, J. (1966). **Toward a Theory of Instruction.** Cambridge, MA: Harvard University Press.
- [3] Gallagher, S. A. (1997). Problem-based learning: Where did it come from, what does it do, and where is it going? **Journal for the Education of the Gifted** 20(4), 332-362.
- [4] Savey, J. R. & Duffy, T. M. (1996). Problem-based learning: An instructional model and its constructivist framework. In B. G. Wilson (Ed.) **Constructivist Learning Environment** (pp. 135-148). Englewood Cliffs, NJ: Educational Technology Publications.
- [5] West, S. A., (1992). Problem based learning: A viable addition for secondary school science. **School Science Review.** 73 (265), 47-55.
- [6] Zirkin, B. & Sumler, D. (1995). Interactive or non-interactive? That is the question! An annotated bibliography. **Journal of Distance Education,** 10(1), 95-112.