Title: Practicing Clinical Decision Making with Simulated Cases: Assessing the Students' Situation Awareness.

1.**Project Proposal:**   There is a significant body of work that has begun to elucidate clinical decision making differences between beginner and expert clinicians in physical therapy and other health professions.[1,2] Several key principles which characterize novice-expert differences appear to cut across many disciplines (e.g. education).[2,3] Understanding how expert clinicians approach a clinical problem, collect data, and arrive at a specific diagnosis and intervention is powerful information for educators as we help usher our students toward this level of clinical skill.

Over the years, I have observed that many educators often teach behind a mental podium. There is a lack of full disclosure of the mental gymnastics that occurs as we think through a problem. We often fail to teach explicitly and instead leave critical information in an implied state that is easily missed or misunderstood. The "black box" remains closed unless the student asks a specific question to shed light on the details. I believe this mainly occurs because the process or journey to an answer becomes so "second nature" to us that we project the clarity onto the students; thinking that they understand it and move on to the next topic.

Similarly, our students remain behind mental desks and, unless prompted, rarely provide any details on how they arrived at a certain answer. The journey to the answer is just as important as arriving at the best answer.[4] Assessing the outcome only (i.e. right or wrong decision) does not clarify why a poor choice was made or capture errors in judgment that were resolved before the end of the task.[5] The purpose of this proposal is to shine a spot light into the proverbial "black box" to illuminate the entire clinical decision making process so that the path is clear to both the student and instructor.

Situation awareness (SA) is a model that has a long history in military applications and, in particular, pilot training. Endsley defines situation awareness as "the perception of the elements in the environment within a volume of space and time, the comprehension of their meaning, and the projection of their status in the near future".[5] This model describes three distinct levels of SA: **Level 1: Perception** of information ("what are the important facts?"), **Level 2: Comprehension** ("what is happening?") and **Level 3: Projecting** into the future (forecasting "what if" scenarios).[5,6] The ability of a pilot to take in all available information from the instrument panel and body senses, process it and select the appropriate response can mean the

difference between survival and death. Likewise, an emergency room doctor needs to have situation awareness to select the best form of care for their critically ill patient. Ignoring important information (e.g. symptoms) or not comprehending their meaning can lead to tragic results in both examples. Investigations of situation awareness in human factors research attempt to understand how individuals collect relevant facts, comprehend the situation and then forecast future events.

The aviation and emergency room examples have a strong time component that requires split second decisions with high stake outcomes. Clearly, most medical situations do not require immediate decisions and therefore, operate on a longer time scale. Can the situation awareness model be used to study these clinical decision making processes? I believe the answer to this question is yes, and the same tools that are used to measure situation awareness with pilots can be adapted to study the clinical decision making process of physical therapy students.

Singh *et al* [6] argue that the SA model can be applied to medical decision making and provides an innovative way to study the diagnostic process toward preventing diagnostic errors. The authors use a clinical case example to illustrate how the SA framework can be used to identify times of reduced situation awareness leading to errors in clinical judgment. Interestingly, the case and associated clinical decisions unfold over a time scale of months suggesting that the SA model is applicable to physical therapy. Although Singh *et al*[6] select a narrowly focused outcome measure, diagnostic error; it does support the application of this model in medical fields and provides a foundation for an expanded assessment of the efficacy of the decision making process and outcomes.

There are several tools for measuring situation awareness. In physical therapy education we often use a post-activity debriefing interview to have the student recall what they were thinking during the activity. The problem with this method is the potential for poor recall or hindsight bias diminishing the accuracy of the information. [6] The Situation Awareness Global Assessment Technique (SAGAT) is a commonly used and validated method which periodically stops the participant to ask specific questions to assess their SA in each of the 3 levels.[5,6,7,8] For example, during a real or simulated patient examination, the student would be periodically stopped and queried on their understanding of the patient problem and confidence level. The

periodic SA probes do not significantly impact performance and mitigate the effects of poor recall and hindsight bias.[5,6,8] At the completion of the examination process, the student and instructor have a clear roadmap of how the student arrived at their final clinical decisions and potential faulty reasoning along the way. An extension of this level of clarity could be computer training modules that are customized for the student to work on a specific component of SA.[5]

Case studies are commonly used in physical therapy education because of their value in teaching clinical decision making without patient risk. Web-based case studies, a program I developed with Dr. Bill Andrews, provide more individualized scenarios and feedback than paper-based cases, making them more realistic and simulating higher levels of patient care decision-making.[9] The student directs an online examination or intervention by selectively choosing tests or interventions from a comprehensive list. The entire process is tracked by recording each selection and answer in a database. This enables educators to evaluate and possibly follow the development of clinical judgment skills by individual students by tracking performance across multiple cases;[9] however, the reasoning behind the clinical decisions **during** each case remains hidden.

This proposal combines a brand new approach to physical therapy education with the web-based case study platform to expose the journey to a clinical decision. To this end, the SAGAT approach will be used to periodically stop the student and assess their level of situation awareness and confidence during each case. In addition an online tool will be developed to allow the instructor to assess individual and group performance during the case and provide feedback to the student(s).

Specific Aims:

Year 1
1. Modify the current web-based case study program to measure situation awareness based on the Situation Awareness Global Assessment Technique (SAGAT).
2. Add 10 complete cases with SA probes.
3. Develop an assessment tool to evaluate the effectiveness of the SAGAT/web-case approach.
4. Host focus group discussions with students and faculty on assessing decision making, SA enhanced web-cases and the potential for generalizing the approach to other disciplines.

Year 2
1. Add 10 more complete cases with SA probes.
2. Implement the use of these cases in several courses in the DPT curriculum.
3. Assessment: Compare web cases with SA probes to regular web cases and traditional paper cases.
4. Present this work on campus and at regional, national or international conferences.

2. **<u>Student Involvement</u>:**   The proposed plan cannot be successful without student involvement during all phases of the project. At the start of this project, a cohort of DPT students will have experience using the original web-based cases and be in a position to provide insight and perspective on their experiences. A focus group format will be utilized to generate discussion on web-cases and the concept of SA and the SAGAT method. This information will be invaluable in helping to develop a method that is minimally intrusive on the simulated patient examination or intervention process but delivers a clear picture of what the students are thinking about as they work through a problem.

In addition to all of the DPT students (~137) participating in the implementation phase of this project, I will have a student assistant throughout the entire project to assist me with developing and implementing the adapted SAGAT tool and a method for assessing the success of this project. Finally, four additional students will be recruited to beta test the SA enhanced web-cases before implementing them in the curriculum.

3. **<u>Project Assessment – Signs of Success:</u>**   Ongoing formative assessment is specifically planned into the project at all stages (e.g. focus groups, beta testing; see the project plan below) of development and will include both students and colleagues in and outside of my department. One goal is to pursue this vision through an intentional and explicit process by gathering and documenting all feedback, suggestions and comments from the various stakeholders to reveal how the program evolves over time. Analogous to the way SA enhanced web-cases are designed to expose the journey in clinical decision making.

A formal assessment strategy will be developed in the first year in parallel with general program development (see specific aim 3, Year 1) to rigorously explore the effectiveness of this novel approach in physical therapy education. Qualitative and quantitative methods will be used to compare student performance outcomes and experiences using SA enhanced web-cases versus regular web-cases and traditional paper cases. For example, a series of cases could be constructed in all three formats (SA enhanced, web-case only, and traditional paper), and then randomly assign the students to one of the case formats followed by a post-test to measure their understanding of the patient problem, compare their conclusions and assess their decision making process.

Similarly, the assessment plan will include an investigation of the impact of SA enhanced web-cases on teaching. Does this method provide additional information on student performance that is not available or too difficult to assess using other methods? Do instructors see real value in using this tool and are they willing to author and implement cases in their courses in the future? A sustained faculty interest for using SA enhanced web-cases beyond the two year scholars program will be a strong indicator of success for this proposal.

4. **Instructor Impact:** In 1999, a small but significant Program Initiative Grant from Elon helped me begin work on developing a first version of interactive web-based case studies for patient examination. The success of the initial project and some enhancements added over the years resulted in several national presentations, one international presentation and collaboration with faculty at other institutions; however, the current state of the program is only a small step toward a much larger vision I have for creating realistic simulations and tracking clinical decision making in physical therapy education.

This proposal represents a leap forward toward my vision and brings together my interest in technology applications in education and non-technical pedagogical methods that I have adopted over the years. In class, I have started to use activities that drill down to the individual student and are designed to get the students to "think on their feet", make a clear decision and explain how they arrive at their answers in front of their peers. For example, this is accomplished in the context of a case presentation in lab with the individual student standing in front of their peers and answering a barrage of questions regarding every interpretation and decision they have made concerning the case. Every student struggles and is pushed out of their comfort zone but feedback from my course evaluations reveals that the students find this activity very rewarding and helpful in the learning process.

SA enhanced web-cases attempts to combine the technological and non-technological approaches by allowing individuals repeated practice with an ever expanding series of cases that are realistic and force the student to make and justify clinical decisions. More importantly, the SA probes will help reveal the students ongoing understanding of the patient problem and how they arrive at their decisions. Ideally, our students

would perform 50-150 of these cases across the curriculum, intermixed with real patient experiences, to raise their level practice upon graduation.

5. **Wider Impact and Dissemination:** The success of this project has the potential to positively impact a wide range of disciplines. There is a natural extension to other health professions, but the same methodology could be adapted to investigate decision making or problem solving processes in many graduate or undergraduate courses (e.g. business, law, and arts and sciences).

The dissemination plan is two fold. First, on campus opportunities will be actively pursued to discuss this work both during (e.g. focus groups) and at the conclusion of the 2-year program. In particular, I will seek out collaboration with other Elon faculty interested in adapting this tool for use in their teaching. Second, this work will be presented at professional conferences to garner interest outside of Elon University. A long-term goal is to generate supportive publications and market the use of the SA enhanced web-cases to the physical therapy education community and other disciplines.

6. **Project timeline and budget**

Estimated Timeline
Development Phase (Year 1; August-March)
- Hold 2-3 open focus group meetings (faculty and student; voluntary) to discuss SA, web-cases, project assessment and potential for generalizing the approach to work within other disciplines.
- Adapt the SAGAT tool for use with the Web-based case studies.
- Upgrade the web-based case studies platform and include SAGAT probes.
- Add and beta test 4 complete cases (neurology related) with 4 students.
- Develop an ongoing assessment strategy.

Initial Implementation Phase (Year 1; April-June)
- Test out 4 cases in the Neurology Module
- Hold a follow-up focus group meeting to discuss the experience with the students. All interested faculty and students will be invited.
- Develop a set of SA analysis tools for the instructor.
- Add 6 more complete cases in other content areas.

Extended Implementation and Assessment Phase (Year 2; July-December)
- Finalize the strategy for assessing the impact of the proposed method on both teaching and learning clinical decision making.
- Implement the use of the SA enhanced web-based cases in several courses.
- Complete a formal assessment of the impact of SA enhanced web-based cases on teaching and learning.

Dissemination Phase (Year 2, January-May)
- Concentrate on disseminating this work both on campus and at regional, national or international conferences (e.g. Combined Sections Meeting in February 2009; PT Annual Conference in June 2009; Elon's Innovations in Instruction conference in 2009)
- Open up the SA enhanced web-cases to other PT programs and other health professions.
- Investigate ways to generalize the approach to other disciplines.

Estimated Budget

Note: After consulting with my department chair and with the director of the Center for the Advancement of Teaching and Learning, I am proposing a modified allocation of resources and budget for this proposal. Specifically, the two 4-hour course load reduction per year compensation is not presently an option for faculty in the DPT program. Finding appropriately prepared and qualified faculty to teach the specialized professional courses is difficult. For the same reason, DPTE faculty generally take their sabbaticals during non-teaching times and have access to additional funding for the proposed work as compensation. Therefore, I am proposing that the funds that would otherwise go to a department for the two course release ($8000.00/year) be made available to my project for funding extra resources to offset any disadvantages of zero release time. Most of the reallocated money ($12,000.00) is for accessing professional software development assistance to create the SA enhanced web-case platform which will significantly reduce the number of personal hours spent programming and help me to concentrate my time on the conceptual framework, implementation and assessment of this project. A smaller amount of the reallocated funds is for a student assistant ($500.00) and for expanding the number of completed cases ($1500.00), with the remainder ($2000.00) going to the project primary investigator as minimal compensation (i.e. stipend) for the additional hours spent on this project without release time (a kind of course overload compensation).

Not having course release time will be a challenge but I believe the strategies I have outlined in this proposal (e.g. professional programming assistance) will enable me to successfully pursue this project while maintaining my normal course load. Formalizing this project within the CATL Scholars program will raise this project to a high priority for me during both teaching and non-teaching times so the work will get done.

Year 1 (2007/2008):
Development Fund (Total: $2000.00)
- Four 1-hour Student/Faculty Focus Groups: $200.00 (refreshments and snacks)
- Case development (n=10): $1500.00 ($150.00 per case to authors)
- 4 Student beta testers: $200.00 ($50.00 to each student for completing 4 cases and providing feedback)
- Miscellaneous: $100.00

Two course teaching reduction equivalent (Total: $8000.00)
- Project student assistant (graduate or undergraduate): $500.00 (~3 hrs per week)
- Software developer (programmer): ~80-110 hours ($7500.00)

Year 2 (2008/2009):

Development Fund (Total: $2000.00)
- Conference: $1200.00
- Project student assistant (graduate or undergraduate): $500.00 (~3 hrs per week)
- Miscellaneous: $300.00

Two course teaching reduction equivalent (Total: $8000.00)
- Case development (n=10): $1500.00 ($150.00 per case to authors)
- Software developer (programmer): ~ 50 hours ($4500.00)
- PI Stipend: $2000.00

Conclusion: This proposal is ambitious but I am passionate about pursuing the aims outlined above and ultimately discovering how the SA enhanced web-cases impact teaching and learning in our curriculum. The CATL Scholars program will provide the resources necessary to achieve the project aims in a two year period that would otherwise be spread out over a much longer time (4-6 years). Finally, I look forward to sharing my ideas with my Elon colleagues and exploring ways to generalize this approach to other disciplines.

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