The influence of video review and iPad apps to enhance visual analysis of movement of the lower extremity

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Background: Visual analysis of movement is both a quantitative and qualitative essential skill for a physical therapist. Physical therapists are challenged to comment on the qualities of the movement of their patients and also visually estimate the quantity of the joint angles to compare to what is optimally necessary for performance of that motion. The current philosophy for teaching visual analysis to students in the program in physical therapy is that the classroom environment should provide experiences that are transferable and usable in the clinic, and enhance the interaction and intervention with the patient. Despite its importance in the clinic, curricular models for the pedagogy for visual analysis in physical therapy are not explicit. However; insight from other professions has noted the increased effectiveness of visual analysis of movement when video review is available (Knudson, 2000). Technology is now available with the iPad mini and the "Ubersense" app that would allow physical therapists to use video review with slow motion options and joint angle calculations in the clinic to improve their clinical effectiveness in visual analysis of movement with their patients. This pilot project examined the effect of adding the use of an iPad mini with a) slow motion and b) the computer app "Ubersense" that estimates joint positions, to the current visual analysis instructional methods in Kinesiology II in the physical therapy curriculum at Saint Louis University. All students completed a worksheet to identify movement faults during a lab in Kinesiology II as well as pre and post surveys regarding their perception of their confidence with this skill. Differences in the student's perception of confidence and performance on worksheet could demonstrate the benefits of using iPad minis and the "Ubersense" app during the visual analysis of a task.

Purpose: There were two identified research objectives:

To assess if the utilization of the iPad mini and the "Ubersense" app during visual analysis of movement makes a difference in a student's perception of confidence performing the skill.

To assess if the utilization of the iPad mini and the "Ubersense" app during visual analysis of

movement makes a difference in a student's accuracy in performing visual analysis of movement.

Study Procedures: An IRB was submitted and approval received. Analysis of the data was initiated and is ongoing.

Twenty-two subjects, between the ages of 18 – 25 years, were recruited from a sample of convenience of students enrolled in the Kinesiology II course in the fall semester of the senior year curriculum in the Program in Physical Therapy at Saint Louis University. With the funds from the CTTL *Try It!* Summer Mini-Grant, 5 iPad minis were obtained. Four additional students who owned iPad minis were willing to participate in the study and were added to the experimental group. 11 students were recruited and placed in the control group. Both groups participated in all of the Kinesiology II labs practicing visual analysis of human movement as taught previously in courses within the Physical Therapy curriculum. Throughout the semester, all students used visual analysis to interpret functional movement activities by watching looped videos of random individuals performing functional movements on a large screen in a lab. During the last lab of the course, all students completed a pre-survey rating their perception of confidence in performing various parts of visual analysis of movement. The students in the control group visually analyzed a functional movement as they have done in all the previous labs: watching a random individual perform a functional movement on a large screen in the lab that has no capability for slow-motion. The video was looped continuously with no ability to start/stop the video based on individual preference or watch it in any other speed. A common worksheet was completed by all students. For this last lab session, the experimental group was in a different room with each student using an iPad mini to access the same movement video that was being viewed by the control group. Through the use of the "Ubersense" app, the students in the experimental group had access to start/stop and slow motion capabilities. In addition, the app on the iPad mini allowed them to document joint positions of the lower extremity during the movement. The instructions allowed the student to self-select the use of these options during video viewing. Similar to the control group, the expectation was for the students in the experimental group to visually analyze the movement and respond to the same common worksheet. At completion of the laboratory session, all students completed a post survey, rating their perception of confidence in performing various parts of visual analysis of movement.

To fulfill the IRB, the lab worksheets were coded by a third faculty member. Discussions between the 3 faculty members involved in the study established a consensus model of scoring the worksheets. Scores were calculated and analyzed. The worksheet scoring had no effect on the participating students' course grade.

Results:

The figures below demonstrate the results of the pre and post confidence surveys completed for this study with a focus on questions 1, 4, and 6 dealing with the critical features of analyzed movement, the sequencing of body movement during execution, and the assistance that technology brings in analyzing movement. Additional analysis of the scoring of the worksheets and the remainder of the self-efficacy survey will be ongoing over the summer.

In Question 1, there was a 23% increase in number of students in the control group and 44% increase in the number of students using the iPad mini whose perception was “somewhat” or “very confident” in determining the critical features of movement.

Q1: Rate your confidence in determining the critical features of the movement

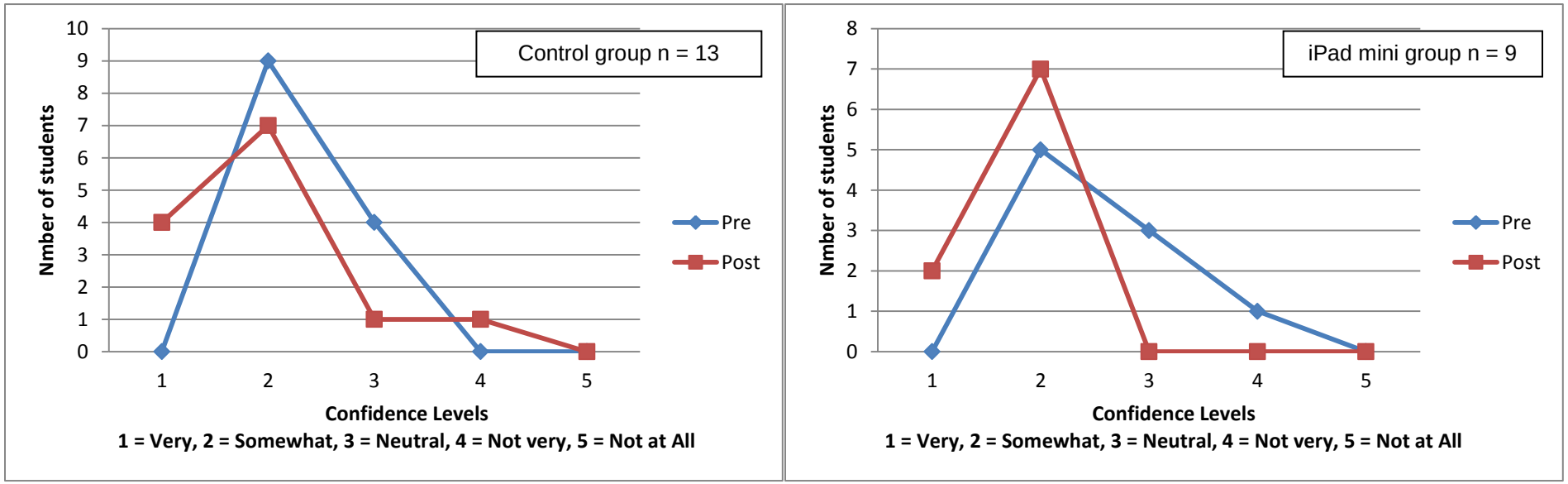
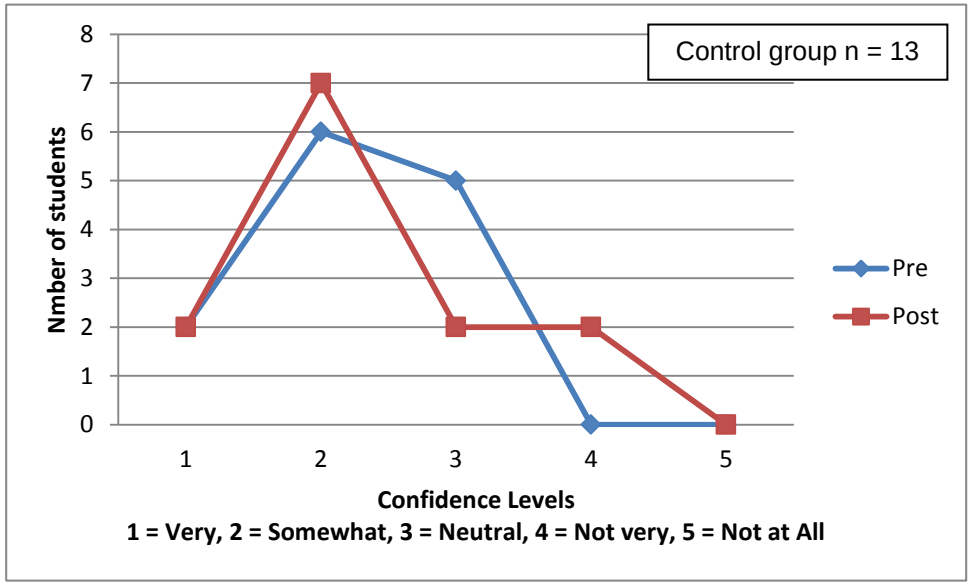


Figure 1

In Question 4, there was < 10% increase in number of students in the control group and a 50% increase in the number of students using the iPad mini whose perception was “somewhat” or “very confident” in determining the sequence of the joints during the execution of the movement.

Q4: Rate your confidence in determining the sequence of the joints or region of the body during the execution of the movement.



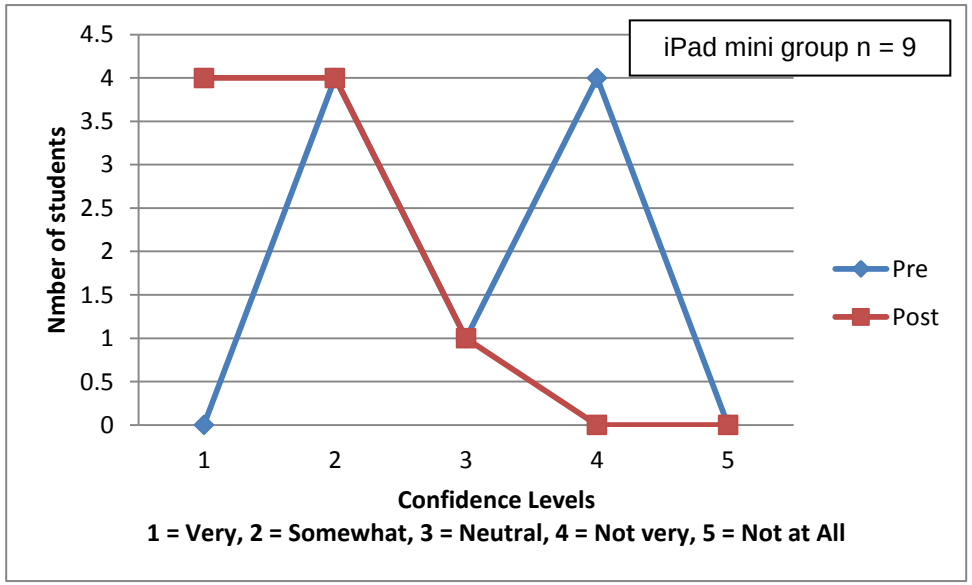


Figure 2

In Question 6, there was < 10% increase in number of students in the control group and 44% increase in the number of students using the iPad mini whose perception was “somewhat” or “very confident” in feeling that technology was influential increasing their perception of greater confidence in visual analysis of movement.

Q6: How do you feel that the technology available today influenced your confidence in assisting with visual analysis of movement?

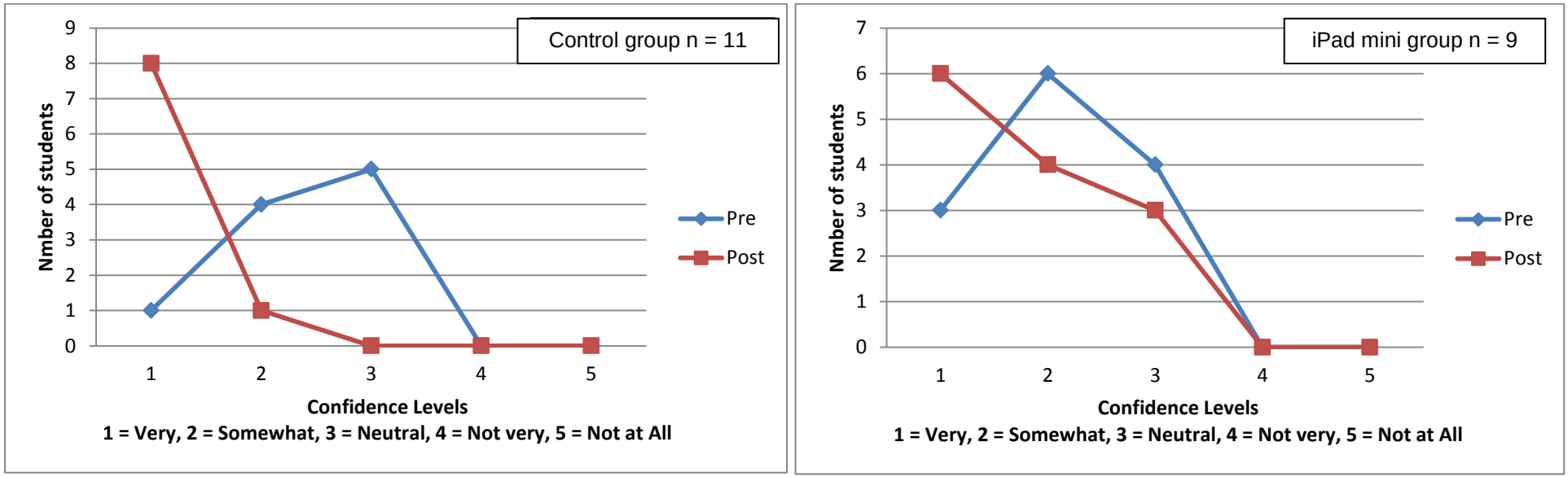


Figure 3

Discussion:

The first objective of the study was to assess if the utilization of the iPad mini and the "Ubersense" app during visual analysis of movement made a difference in a student's perception of confidence performing the skill. Knudson (2000) noted increased effectiveness of visual analysis of movement when video review is available. Optimal repeat viewing was reported to be 5 – 8 repetitions with the availability of slow motion review to enhance the observer's ability to analyze the motion. Additionally, Knudson and Kluka (1997) found that humans can have a visual accuracy of +/- 5° of static postures or slow movements. Self efficacy is the perception that one can successfully depict the behavior required for competency in a particular situation or skill; an increase in perceived confidence in the activity (Bandura, 1977). Figures 1 and 2 reflect the responses to questions on the confidence for two different components of the skill of visual analysis of movement. As noted, there was a change in self-efficacy in both groups. Overall, the percentage of experimental group members that moved to a "somewhat confident" or "highly confident" perception was greater than in the control group. Therefore, while this study had a small sample size, it does appear to support these insights from other professions noting an increase in perceived confidence of visual analysis of movement when video review is available. Though it is unknown how often the experimental group accessed the available options of the "Ubersense" app, including, repeat viewing, slow motion review, and joint angle calculations, the experimental group definitely perceived an advantage in the availability of these options to improve their clinical effectiveness in visual analysis of movement. This is illustrated in Figure 3.

The second objective of the study was to assess if the utilization of the iPad mini and the "Ubersense" app during visual analysis of movement made a difference in a student's accuracy in performing visual analysis of movement. In analyzing the worksheets of the students' visual analysis of movement; discrepancies in the interpretation of the directions, the completeness of the worksheet itself, and clarity of answers were noted. Despite efforts to ensure reliability and validity of the scoring the worksheets, the accuracy of the student's answers were unable to be assessed. The inability to achieve this objective and the experience provided by the CTTL *Try It!* Summer Mini-Grant allowed for several pedagogical issues to be identified which led to a post-hoc objective to assess pedagogy throughout the physical therapy curriculum on visual analysis of movement. The goal of this assessment is to improve the presentation of this material in future courses, and perhaps improve the accuracy by students in the identification of movement faults through visual analysis of movement.

Of note, the following were lessons learned from the discussions on the discrepancies from the students' lab worksheets.

1. The terms used with visually analyzing movement should be specifically defined and there must be consensus among the faculty with utilization of the terminology across the curriculum. This is challenging as these terms are not explicitly defined and accepted throughout the profession of physical therapy.
2. The faculty members involved in disseminating the information pertaining to visual analysis of movement must participate in developing the worksheets in order to ensure an integrated strategic approach to visual analysis of movement that is woven through the entire physical therapy curriculum. These worksheets are currently intended to move from foundational knowledge to more complex, higher order reasoning as the student progresses through the curriculum.
3. Faculty must modify their expectations for accuracy based on student progression through the program. For example, in the beginning of the curriculum the expectation should be that students will be able to identify gross movement faults, but by the end, it should be expected that the students will notice subtle details of movement.

In conclusion, despite the fact that we were unable to score the accuracy of each student's lab worksheet; literature on self-efficacy states that experiences which are non-threatening and/or non-punitive lead to an increase in perceived confidence in the activity and a corresponding change in behavior (Bandura, 1977). If one believes that change in behavior is synonymous with accuracy or competency of a skill, the results of this pilot study would indicate that those students in the experimental group who perceived greater confidence would demonstrate greater accuracy in the skill of visual analysis of movement. However, as the needed data point for accuracy could not be analyzed, we were unable to definitively fulfill the second objective of this study. Future studies on the accuracy of visual analysis of movement by students would necessitate changes in the presentation of the curricular materials associated with visual analysis of movement and the inclusion of repeated experiences throughout the curriculum emphasizing the use of technology.