Final Progress Report for 2007 NWACC Proof of Concept Program

1) Project Identifiers

Project Title: Improving the Undergraduate Exercise, Sport Science and Pedagogy Learning Experience with Computer-assisted and Video-based Motion Analysis Technology

Investigators: D. Clark Dickin, Ph.D. Assistant Professor, Grace Goc Karp, Ph.D. Professor, Department of Health, Physical Education, Recreation and Dance.

University of Idaho – HPERD
Box 442401
Moscow, ID 83844-2401

Email: cdickin@uidaho.edu
gockarp@uidaho.edu
Website: www.educ.uidaho.edu/dartfish learning
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2) Statement of Project Goals

Overall the goals of this NWACC proof-of-concept grant were to acquire and integrate a video-based motion analysis system into the undergraduate curriculum in Exercise and Sport Science, followed by the Pedagogy curriculum. Most motion analysis systems cost in excess of $10,000 and often times more than $50,000 per system. Although the Dartfish motion analysis system is not designed to be used to conduct quantitative motion analysis used in biomechanics and motor control, it has found its place in the areas of pedagogy, coaching, and skill analysis and acquisition. Through the use of the Dartfish software package the user is able to control video files of virtually any performance by slowing the playback down to as slow as frame by frame. Perhaps more useful in some ways is the ability of the software to superimpose, or place side-by-side the performance of another performer or that of the same performer from early performances. With this functionality the instructor and the student can control video playback to help facilitate the learning process in many ways.

Utilizing this software the current grant worked to incorporate the use of the Dartfish movement analysis system into an upper division motor behavior course in the Health, Physical Education, Recreation and Dance department at the University of Idaho. The course is required of all students enrolled in not only exercise science and health, but also pedagogy, athletic training, and dance. With its lecture and lab format the motor behavior class was chosen to incorporate the technology during the fall 2007 semester. The course has enrollments of approximately 60-75 students in the lectures and 12-15 in each of the labs. Within the motor behavior class all three of the focus areas of motor behavior are covered (i.e., motor development, motor control, and

motor learning). It was the goal of this project to incorporate the use of video-based motion analysis into the laboratory experiences. To do this two lab experiences were identified – with one focusing on the role of video as a source of demonstration and the second lab focusing on the role of video as a source of augmented feedback. Following the incorporation of the video-based motion analysis into the laboratories of motor behavior future opportunities to incorporate the technology into other classes within the various curriculums of HPERD will be visited and incorporated.

3) Discussion of results and extent to which goals were met

During the summer of 2007 the majority of the equipment necessary to accomplish this project was acquired, with the final purchases made after the final two thousand dollars of the grant were disbursed. Leading up to the fall 2007 semester the PI's worked to develop expertise in the use of the Dartfish software and its integration with the various video cameras purchased with the grant. Using the motor behavior class as a pilot class to begin to integrate the technology two laboratory experiences were chosen to utilize some of the motion analysis tools available with the Dartfish software package. Although there are numerous ways in which to utilize the software, time constraints and the nature of the class required us to choose a few of them. The options chosen were ones in which the students could control the playback speed and zoom features of the program.

The first attempt to incorporate the video based movement analysis software into the undergraduate curriculum was successful. It was discovered that the ability to observe and control the play-back of the advanced performer did result in improved juggling performance, without the need for an expert to provide augmented feedback to the performer. The improved level of skill acquisition seen in the video based learning group was as good as those viewing a learning model while receiving feedback from an advanced performer, and twice that of those practicing on their own. As a result, this laboratory experience has demonstrated that a computer based motion analysis software program, like Dartfish, can be used to begin the learning process and allow the performer to be actively involved in the learning process. Given the preponderance of research showing that active involvement in learning as well as being involved in assessing ones' own performance are critical to the learning process, utilizing this form of video-based demonstration provides another method of skill instruction. The appeal of the video-based demonstration, especially with the control offered in motion analysis software, is that the need to have skilled instructors in all skills may be reduced, at least during the early stages of learning.

In our second attempt to integrate video-based motion analysis into an undergraduate motor behavior class, we conducted a laboratory experience in which individuals viewed their own performance as a form of feedback immediately after performing the movement. The use of video-based motion analysis as a form of performance based feedback proved to be a useful tool in skill acquisition. As a function of observing ones' own performance we have demonstrated that for the skill of volleyball setting performance can increase to a level higher than that of just practicing the skill, and even higher than through the use of an advanced performer as a source of feedback. Despite this finding much research is needed to substantiate these results. Since the goal of this laboratory experience was not to quantify learning in an experimental setting, but rather to engage students in skill acquisition by exposing them to various sources of performance related feedback we feel it was successful in doing so. By allowing the students to view their own performance and incorporate the information obtained immediately into practice, the students were able to see the benefit of such technology in a motor skill setting. With the reasonable price of the Dartfish software educational institutions across the country could incorporate this technology into the classroom and also into the any and all athletic environments. With only the need for a video camera and a computer to run the software (potentially a laptop) data collection and skill instruction can be conducted anywhere.

4) Impact and future plans:

Based on the initial integration of the video-based motion analysis technology into the HPERD curriculum it will be a useful tool in the development of future professionals and in their development of students, athletes or any person attempting to learn a motor skill. The initial attempt at utilizing this technology was in skill acquisition, and the results were very positive. Students rated the laboratory experiences as an overall 3.6 on a 4.0 scale. The felt that the material covered in lab was not only helpful in facilitating an understanding of the course objectives but also showed the students alternative ways to integrate technology into the classroom.

We are working on developing plans for integration into several skill analysis courses, and additional Exercise science courses in future semesters. With courses within the department moving to a once a year offering we are limited in the number and time of integration with courses. In the fall 2008 and spring 2009 semesters the Dartfish system will be used in as many as five different courses, with future integration into additional courses and graduate courses in Exercise Science to follow. One major limitation with our initial cameras purchased for this project was their relatively slow speed (Frame rate) of 30 frames per second.

When looking at or analyzing human movement it is not uncommon to be moving in excess of 30 meters per second (hitting a baseball) or show movement speeds of up to 6000 degrees per second (pitching a baseball). So with the final installment of the grant we purchased a high speed camera capable of 210 frames per second. With the new camera we will be able to better view rapid movements with substantially less blurring.

Now with the systems in place the integration of the Dartfish system will occur in several of the skill analysis courses within the teacher education program, in addition to the biomechanics of human movement laboratories and with continued use in the motor behavior laboratories for years to come. As this was designed to develop the groundwork for integration into the undergraduate curriculum we feel that the grant was successful in doing so. In terms of the impact of the project its initial effects were very positive but we will not have a full understanding of the overall impact until we have been able to utilize the software in several classes and begin to look at some long-term impact on student as they progress through the various curriculums in HPERD. Additionally with the training of many future professionals in the fields of HPERD the experiences gained as a function of using the Dartfish systems will hopefully result in its integration in not only K-12 curriculums, but also in various coaching and allied health science settings (e.g., Physical and Occupational Therapy and Athletic Training settings).

5) URL's of related websites.

The main project website is at http://www.educ.uidaho.edu/dartfish_learning

Other possible related web links would include the main page for the Dartfish system at http://www.dartfish.com/en/index.htm

6) The current grant was highlighted in the following newsletter: http://coe.ed.uidaho.edu/uploads/1/documents/Newsletter/MayNwsltr.pdf

7) Final Budget Statement

See attached PDF file.