Running head: COGNITIVE FLEXIBILITY

Cognitive Flexibility: Enhancing Physical Education Programs with Technology

Scott Brown

Kansas State University
Cognitive Flexibility: Enhancing Physical Education Programs with Technology

Technology has accounted for many changes in education. It has changed the way teachers teach. These changes range from the method instruction is delivered to the attitudes on how learning occurs to the amount of collaboration and knowledge sharing between teachers. “Teaching and learning with technology has had a significant positive effect on student outcomes when compared with traditional instruction” (Waxman, H., Lin, M., & Mitchko, G., 2003). It has changed the way learners learn. “Technology is a part of students' everyday lives, and substantial advances in technology have profoundly affected the way they learn” (Podolski, 2008). It is clear technology can be a powerful tool to engage students and enhance learning. How can technology be implemented to enhance student learning in physical education programs? When considering the role of technology in physical education programs, several important questions will be addressed. What is cognitive flexibility and how does it relate to using technology in physical education? What technology options are available for physical educators? What is the role of technology as an assessment tool? And finally, does technology help advocate the importance of physical education programs?

Cognitive Flexibility

The Cognitive Flexibility Theory focuses on the nature of learning in complex and ill-structured domains (Spiro, 1988). Spiro & Jehng (1990) state: "By cognitive flexibility, we mean the ability to spontaneously restructure one's knowledge, in many ways, in adaptive response to radically changing situational demands” (Spiro and Jehng, 1990). The learning environment presents multiple perspectives on the content, is complex and ill-defined, and emphasizes the construction of knowledge by the learner.
Cognitive flexibility (Jonassen, Ambruso & Olesen, 1992). Cognitive flexibility requires that a student is able to transfer knowledge from situation to situation. The application of the knowledge changes with the environment, allowing the learner to use the knowledge they have constructed to solve the current problem.

Available Technology, Assessment, and Advocacy

There are many good options available to physical educators in regards to technology. Many of these technologies are easily accessible and are easily incorporated into the curriculum without major changes.

Pedometers are an example of technology that is easily incorporated and addresses motivation, assessment, and advocacy. Recently, the pedometer has become an acceptable tool for measuring physical activity. Students can wear a pedometer and receive immediate, continuous feedback regarding their activity level (Beighle, Pangrazi, Vincent, 2001). Numerous studies have shown pedometers to be reliable with both adults and children (Bassett, Ainsworth, Leggett, Mathien, Main, Hunter, Duncan, 1996; Gretebeck & Montoye, 1992). Pedometers offer one more means of demonstrating to the public that students are achieving levels of physical activity. Additionally, they give parents and children a way of discussing how active they should be, including setting goals for activity (Beighle, Pangrazi, Vincent, 2001). When students have a goal that is attainable and they can see progress towards that goal, they are motivated to continue the process.

Heart rate monitors are another option for incorporating technology into physical education. Heart rate monitors can provide immediate feedback that can make students work harder (Bian, Partridge, King, Anton, Boyer, 2007). The use of heart rate monitors
helps make the learning more student-centered, as it is based completely on the student’s ability level and current level of fitness. As fitness levels increase, students can see that cardiovascular benefits are being achieved. Individuals with greater cardiovascular endurance must work harder to achieve desired heart rates, giving students an individualized goal to work towards. Heart rate monitors provide students real-time data that allow them to see how different exercises and activities affect heart rates. Although a heart rate can be determined by counting pulse rates in the neck or wrist for a set period of time, a heart rate monitor is more convenient, and it allows children to use up-to-date technology (Kirkwood, Mahon, 2002). Charts of maximum heart rates can be made for each child, and subsequent physical activities can be the source for more measurements of heart rate. These measurements can be graphed, looked-at as proportions, provide ranges of "more" and "less," and can be used in math problems for many grade levels (Kirkwood, Mahon, 2002).

Using video provides many opportunities for enhancing student learning. An application that can enhance virtually every area of the physical education curriculum, both in research and in teaching, is the motion analysis system. The advent of digital video cameras has simplified the collection of data. These results can then be imported to interactive multimedia presentations to provide students with a better understanding of the importance of breaking skills into components and the consequences of subtle variations in technique (Ladda, Keating, Adams, Toscano, 2004). The technology can help teachers monitor student progress toward motor skill goals, provide opportunities to give feedback, and create ideal situations for assessment of student learning (Fiorentino, Castelli, 2005).
Simulation and games have a place in the physical education curriculum. Games such as Dance, Dance Revolution and FX Cycles create opportunities for students to be physically active as well as the opportunity to enjoy doing it. These types of games are engaging to students. They may also be combined with other technologies to enhance the experience (DiGiorgio, 2004).

Fitness software is becoming a valuable tool in physical education programs. Subject-specific software is available for anatomy, body composition, dance, assorted sports, and other fields (Mohnsen, 2001). Various fitness software programs allow teachers to input and track progress over time. Many programs include an option to print reports for students to see and share with parents. If parents are able to see the long term success and benefits of their students in physical education, it gives the program more value. The ability to see results over time can also be a powerful motivator for students. If they can see how what they are doing is affecting them, it makes the learning meaningful. In addition, there is software that will help teachers and students to create portfolios. The long term tracking of student fitness components is not only valuable in assessing student performance, but it also allows teachers to evaluate the overall effectiveness of their program and make changes accordingly. Programs that are constantly reflecting and adapting to meet student needs develop into strong programs, giving it more value than those that do not. This may be a factor when administrators consider which programs to keep and which to cut.

Despite some application requirements, webquests provide another means of integrating computer technology into physical education classes in order to enhance student learning. Webquests can be short-term and long-term. Either type of webquest
can be implemented in physical education settings without interfering too much with physical activity time. By their very nature, short-term webquests would not replace too much activity time, and they could be assigned as homework to be completed outside of class. When thinking about webquests to be completed outside of class, considerations must be made regarding student access to technology outside of school. Teaming with other teachers and using long-term webquests as a means of cross-disciplinary integration is a way to avoid conflicts with student activity time. Webquests are not only useful for student outcomes, but provide opportunity for collaboration among teachers.

Collaboration may change the image of the physical educator in the eyes of their colleagues. They may better understand and appreciate the role of physical education as it relates to student learning and achievement in other subjects. This understanding and appreciation becomes important when promoting your program and provides opportunity for future collaboration. Both types of webquests can also serve as alternative learning activities for students who are temporarily unable to participate in physical activity due to medical or other reasons (Woods, Shimon, Karp, Jensen, 2004). Research in online learning suggests that students can learn as effectively as in face-to-face instruction (Bennett & Green, 2001; GocKarp & Woods, 2003).

Each of the technologies discussed provide ways to aid in the assessment of student skills and knowledge. As children perform exercises and skills, we can use tools and systems to quantify processes and results to help them learn more about themselves (Kirkwood, Mahon, 2002). In a broad sense, technology can be used to help make assessment more manageable. Quick and easy assessment, with the ability to record and store data over time, is beneficial to teachers and students. Engaging students with
technology allows them to participate in research and creating authentic products for assessment. Integrating technology gives students opportunities to connect previous knowledge and new knowledge and experiences (Boe, 2008). These technologies allow teachers to create alternative assessments or ask students to apply knowledge or create something in a real-world context using newly gained information. Alternative assessments can help students of all ability levels to feel excited about physical education (Sinclair, 2002). This allows teachers to gain a broader and perhaps more accurate picture of student learning. Students are engaged in meaningful learning, which involves higher-order thinking, rather than rote learning, or the memorization and regurgitation of information. Students must be able to adapt knowledge to changing situations. The skills gained will be valuable to students across the curriculum, branching into other subject areas. Cognitive flexibility provides a powerful tool to advocate the importance of physical education.

Conclusion

Making technology part of the physical education program has many benefits. Most importantly, it greatly enhances student learning. Technology is a powerful instructional tool. “Students will use engaging technologies in collaborative, inquiry-based learning environments with teachers who are willing and able to use technology’s power to assist them in transforming knowledge and skills into products, solutions and new information” (Nesbit, 2007). With the recent concern regarding obesity in children, the use of technology in this manner can support the physical education instructional program and reach students who may not otherwise be engaged in physical education learning (Mohnsen, 2005). There are many inexpensive and easily obtained technologies
available for physical educators to incorporate into their program. If funding and school budgets are a concern, there are creative ways to secure funding for technology. One article suggests:

In pushing for increased technology funding in schools, administrators seem more comfortable backing core subjects such as math and reading where the benefits are obvious. Math, science, reading, writing, technology, and learning about cultural diversity are skills and lessons that are positively reinforced daily through a physical education course (DiGiorgio, 2004).

Another suggestion is to mention to administrators and potential funding agencies that you are currently addressing or plan to address both the NETS-S and physical education standards. This may give you an advantage when asking for additional technology for your program (Mohnsen, 2005).

Technology is an important assessment tool. It aids teachers in managing traditional assessment, as well as provides opportunities to develop alternative assessments. This becomes important when trying to reach all learners and consider all of the multiple intelligences.

Technology can be used as an advocacy tool. As the push to decrease or completely eliminate physical education programs gains more momentum, it becomes necessary to show its worth in the overall education process. Technology gives you the tools to help accomplish this task. It allows you to collect and store data and provide tangible evidence that what physical education provides to students is worth the investment in time and money.
Technology is a valuable asset to any physical education program. It is a powerful instructional tool, an assessment tool, and an advocacy tool. It engages students, making the learning fun and meaningful. A combination of these characteristics enhances student learning.

References:


Wei, B, Partridge, J., McClary King, K., Anton, P., and Boyer, M. "Impact of technology-enhanced curriculum on high school students' physical activity participation.(PEDAGOGY)." Research Quarterly for Exercise and Sport 78.1 (Feb 2007): A-50(1).