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Wellness NutriFit Online Learning in Physical Education for High School Students

Grace Goc Karp and Marianne L. Woods
University of Idaho

Abstract

Understanding the learners' perceptions of how online delivery is affecting their learning will help provide instructors with information to effectively design and use online delivery strategies (Gallini & Barron, 2001). The purpose of this pilot study was to examine the learning and perceptions of students and their instructor during online fitness and nutrition units. The study participants were 19 high school students enrolled in a semester-long wellness course (10 males, 9 females; average age: 16 years, 2 months), and their teacher. The online units lasted 2 weeks each with a 3-week activity component interval in between. Student and instructor perceptions of the online instruction were examined through interviews and surveys. The majority of students (92%, n = 12) indicated that they were able to perform basic operations on their computers and valued the importance of technology in learning and finding employment. Student achievement was measured using a knowledge test and course assignments. A dependent t test on pretest and posttest scores showed a significant gain in student knowledge. Student perceptions of online learning were mixed. On the positive side, they indicated online instruction was suitable for some learning styles, focused their learning better, and allowed them to work at their own pace and at home. Yet, they had problems navigating the technology, were unclear about which content would be assessed and missed contact with their teacher and peers. The instructor had similar perceptions. She felt disconnected from her students and not in control, got behind in her grading and belatedly realized she could have helped her students by interacting more online. Despite mostly positive responses after the first unit, students and instructor ultimately favored a mixed instructional format using online and face-to-face instruction.

Computer use in the teaching-learning process has increased dramatically in the last 20 years. More than 80% of K-12 students reported using computers for learning purposes either in school or at home in 1996 according to National Assessment of Education Progress (NAEP, 1996) statistics (Bayraktar, 2001-2002). This was nearly a 30% increase from 1984. Along with the increase in usage and availability of technology, K-12 teachers are facing increased expectations to integrate technology into their curriculums. These expectations are highlighted in standards for teachers and students that relate to technology. For example, professional organizations such as the National Council for Accreditation of Teacher Education (NCATE, 1997) and the International Society for Technology in Education (ISTE, 1998) have established such standards (Scheffler & Logan, 1999; Vannatta & Beyerbach, 2000). Besides meeting standards,

there are expectations for teachers to (a) use instruction that prepares students for present and future social and economic demands (Thornburg, 1992); (b) apply current, research-based approaches to teaching and learning via the use of computers (Bracey, 1993; Thornburg, 1992); (c) understand technology (Topp, Mortensen, & Grandgenett, 1995); and (d) use technology and do so according to the guidelines and mandates from district and professional bodies (Ramirez & Bell, 1994, Thomas, 1994; Widmer & Amburgey, 1994).

These expectations to integrate technology into units of instruction have created daunting challenges for teachers (Clark, 2000; Gallini & Barron, 2001-2002) and "many teachers are still sitting in their classrooms staring at their computers" (Goddard, 2002, p. 25). Training efforts aimed at improving teachers' proficiency and integration of technology have typically resembled a cafeteria approach that includes numerous sessions on various technology skills. This strategy has failed to assist teachers in planning and developing technology-rich lessons and learning activities in their specific content areas (Vannatta & Beyerbach, 2000). Not only do teachers need the technology skills to integrate computers into their curricula, they also need an understanding of how teaching with computers will affect their teaching practice. Computers change "the arrangement of [the] classroom, social organization of student learning, and interactive patterns between teachers and students" (Weng, 2002, p. 151). Adoption of technology-based instruction may require teachers to reconceptualize their beliefs about teaching and learning (Niederhauser, Salem, & Fields, 1999).

The prevailing teaching-learning theory currently associated with the integration of technology into education settings is constructivism. Constructivism is built upon the following set of related ideas and offers a coherent framework for designing and implementing technology-based learning experiences:

- The individual learner actively constructs his/her own knowledge and meaning from experience and content (Fosnot, 1996; Gallini & Barron, 2001-2002; Gonzales & Sujo de Montes, 2001).
- Knowledge construction is a process whereby the learner accommodates or assimilates new understandings with prior knowledge (Adams & Burns, 1999; Gallini & Barron, 2001-2002).
- Learning is mediated by social contexts and cognitive tools, including technology (Adams & Burns, 1999; Gallini & Barron, 2001-2002, Jonassen & Reeves, 1996).
- The roles of teacher and learner are consistent with a student-centered model. Teachers are facilitators of learners' knowledge constructions and base decisions on students' prior knowledge, the social dimensions of learning, high standards, and assessment of learning in order to support learners becoming self-motivated, actively involved in learning decisions, and reflective about their learning (Gallini & Barron, 2001-2002).

These basic tenets of constructivism require a shift from teacher-centered models in which teacher talk is dominant, structured time frames constrain class activities, knowledge acquisition is the focus, traditional tools of instruction prevail, and the class agenda is mostly determined by the teacher (Gallini & Barron, 2001-2002).

For many teachers this shift in beliefs about teaching and learning and the practices consistent with such a shift may be very difficult; however, a couple of suggestions have been made for alleviating the difficulty (Vannatta & Beyerbach, 2000). One is for teachers to collaborate with individuals who have strong technology skills and more experience with using technology in teaching. The other is to partner higher education faculty with K-12 teachers. Collaboration with higher education faculty may help bridge the theory-practice gap in technology integration. Parties involved in technology partnerships need to be aware, however, that the development of the skills and understanding necessary to successfully integrate technology into the classroom takes time and can involve setbacks (Weng, 2002). Rogers (1995) outlined a five-stage process that teachers typically undergo when implementing technology into their classes:

1. Knowledge stage. This stage applies to teachers who are not yet users of technology, though they are aware of its existence. Dissonance for teachers can be high.

2. Persuasion stage. Teachers gain information about available technology from trusted peers and support using technology for traditional productivity (grading, electronic correspondence). Their level of discomfort declines as new information is assimilated.

3. Decision stage. Teachers choose to accept or reject new changes related to technology. They might use technology to assist traditional tasks or to enrich the curriculum (e.g., exploring Web sites, using CD-ROM resources, doing word processing). Student applications at this stage are teacher-directed.

4. Implementation stage. The teacher views technology as a relevant tool for teaching and learning. Learning experiences are designed that involve technology applications and that are tied to learning objectives. There is a shift toward student-directed inquiry and product development that focuses on higher order thinking skills and on using technology.

5. Confirmation stage. Teachers invent new technology applications and collaborate with other teachers to create consistency in technology uses across subject areas.

This stage process does not guarantee that all teachers will ultimately be able to effectively integrate technology into their classes. Gallini and Barron (2001-2002) point out that the research on teachers' implementation of technology is consistent with the literature on innovation adoption. That is,

> Typically, the process starts slowly, attracting small but increasing numbers as new adopters enter during the early stages. As awareness grows regarding the benefits of the innovation, additional members of the community adopt the innovation. The more skeptical group, estimated to be one third of the total population, adopt during the later stages, after the innovation has already peaked. The originally highly resistant group—about 16% of the population—join in the ranks at the end of the cycle. (p. 145)

This research suggests that educational leaders must understand the attitudes teachers have about technology and how those attitudes influence the application of technology in their classes (Clark, 2000). So, too, must students be considered in efforts to implement technology.

Essential to applying constructivist theory to technology integration is the idea that the student is central and active in developing knowledge and meaning and the understandings and attitudes that s/he brings to the learning environment are mediating factors in the learning process. Currently, there is considerable support for computer-based education (CBE) based on research on student achievement. Various meta-analyses conducted on studies comparing outcomes of CBE with traditional instruction have found moderate effect sizes in favor of CBE. Effect sizes around .2 are considered small while .5 is considered moderate (Bayraktar, 2001-2002). Meta-analyses conducted on studies from elementary through college level have found average effect sizes of .38 to .48 in favor of CBE in a variety of discipline areas (Khalili & Shashaani, 1994; Liao, 1998). This means that the students in CBE scored from more than one third to nearly one half of a standard deviation higher than students in traditional instruction. The advantage for CBE varied, however, when factors such as instructor bias, duration of instruction, type of computer application, and the possibility of CBE supplementing or replacing face-to-face instruction were considered. For instance, instructor bias refers to whether the same instructor taught both the CBE and face-to-face comparison groups or a different instructor taught the two groups. The effect size findings for this factor have not been consistent, sometimes favoring instructors who taught in both settings (Kulik & Kulik, 1986; Liao, 1998), other times favoring different instructors (Bayraktar, 2001-2002; Lowe, 2001-2002). Bayraktar and Lowe argue that student achievement may be more dependent upon different teaching styles or their instructional effectiveness than on whether computers were used. More consistent results were associated with the instructional role of computers, however. When computers were used as a supplement to regular instruction, effect sizes were larger than when computers replaced regular instruction (Bayraktar, 2001-2002, Kulik & Kulik, 1986; Liao, 1998). Despite the findings that student achievement can be enhanced through CBE, learning via technology may not be suitable for everyone.

Typically, students who have found success in learning via computers are "over 26 years of age, highly motivated, self-disciplined, goal oriented, having average or better verbal and quantitative skills" (Gonzales & Montes, 2001, p. 63). This finding highlights the importance of needs assessment in designing appropriate CBE, especially when constructivism informs the design. If the learner is truly the central figure in the instructional design, then what s/he brings to the teaching/learning context must be considered. And what many learners bring to the teaching/learning context is a history of experience in a teacher-directed learning environment. Therefore, they may be comfortable as passive recipients of information, minimally involved in decisions of what they learn or how they show what they have learned. These attitudes were suggested in research on CBE with college-level students. Undergraduate students indicated discomfort with making learning decisions and some of them preferred a completely teacher-directed model and many of them desired mixed teacher- and student-based instruction (Gallini & Barron, 2001-2002). There is a paucity of research on K-12 student perceptions of CBE, though what exists suggests that students' positive attitudes toward computers, motivation, and creativity influence them to take control for their learning, stay on task, and pursue problem solutions that are more obscure and hypothetical (Hopson, Simms, & Knezek, 2001-2002). It is also likely that students' prior experiences with computers influence their attitudes toward them (Ayersman, 1996) and the

effectiveness of computers in their learning (Kulik & Kulik, 1986). These findings have implications for a progressive integration of technology into the curricula. The progression should include strong, initial support with frequent teacher interactions; clear, specific guidelines to students for active learning; and flexibility for student decisions in the process (Geiger et al., 2003). Effective computer-based instruction is no different from face-to-face instruction in that "teachers must provide prompt feedback, emphasize time on task, communicate high expectations, and respect diverse talents and ways of learning" (Goddard, 2002, pp. 23-24).

While there are increasing demands placed on teachers to incorporate technology into their classes, there are few studies at the K-12 level that examine the process of meeting these demands both from the teacher's and students' perspectives. A search in the area of physical education found no data-based studies on technology integration. Bennett and Green (2001) state, "Research on student learning through technology within a physical education setting is almost nonexistent" (p. 2). A recent project in health education (Geiger et al., 2002, related to nutrition, physical activity, and prevention of substance abuse software content, examined training effects on health educators and middle school student interest in this interactive software. Results indicated increased confidence and interest in using the software on both the health educators and students. Considerable effort, in-service time, and funding contributed to the success of the project.

Strategies for providing appropriate and meaningful technology-mediated environments in these areas need to be examined. Understanding the learners' perceptions of how online delivery is affecting their learning will help provide instructors with information to effectively design online delivery strategies (Gallini & Barron, 2001-2002). We designed and implemented a study that integrated technology into a high school wellness course, specifically for units in physical fitness and nutrition. This paper describes what we did, how the instructor perceived the process of technology integration, and how students responded to learning online. Thus, the purpose of this pilot study was to examine the learning and perceptions of high school students and instructor in online units on fitness and nutrition in a wellness course. Specifically, the following questions served to guide the study:

1. What technology background did students bring with them into the class, and how important do students see technology applications?
2. What were online student perceptions of the course, and how did they change over the course of delivery?
3. What were the perceptions of the instructor over the course of the study?
4. Was there any difference in student learning between students who were taking the online course versus the face-to-face course being delivered at the same time?

Method

Course and Course Content

Units on fitness and nutrition are required as part of Physical Education and Wellness, an elective course for high school students in this northwestern school. The course is designed to develop knowledge, skills, and dispositions in factors influencing

wellness. The high school instructor, Ms. Riley, has taught the course content face-to-face for 23 years.

The instructor had limited experience with online courses, however, had implemented technology (Dine Healthy, a nutrition analysis computer program; heart rate monitors) in the course. Ms. Riley had ambiguous feelings towards the expectation to infuse online learning in her classes. Her reasons were associated with her philosophy about learning environments and a perceived threat to job security. The school district is strongly encouraging the application of technology in classrooms and is excited about this plan.

Content for the two units, Fitness and Nutrition, was identified by the instructor. Using grant money provided through the National Center for Online Learning Research (NCOLR) in 2002, two graduate students and the researchers developed the content for online delivery. Content for the units were organized into sections with corresponding assignments and class activities. Ms. Riley and the researchers reviewed the content and made suggestions for organization, presentation and delivery modification numerous times during the development process.

Course Delivery

The Idaho Virtual Campus (IVC) was used to deliver the course content online. The first unit, Fitness, was delivered at the beginning of the fall semester and lasted 8 days. This was followed by eight days of physical activity to complement the content taught in Fitness. Following these activity days, the students continued with the online unit, Nutrition, for 12 days. During the same time period, another class received the same content in a face-to-face context from the same instructor.

Participants

The subjects included high schools students (average age: 16 years, 3 months; 9 females, 10 males) enrolled in an online course delivery of fitness and nutrition units, and high school students (average age: 15 years, 11 months; 14 females, 9 males) enrolled in a classroom-based delivery of fitness and nutrition units. The instructor who delivered both courses was trained in the delivery of the online course. In addition, the researchers provided assistance in online delivery both within and outside class time.

Instruments

Student Technology Survey

To examine students' attitudes towards technology, a survey about students' perceptions of technology use was developed and implemented. The major components of the survey included questions about computer competency, use of technology in communication, schoolwork, research, and creative work and their perceptions of the value of technology use. The survey was administered to both classes at the beginning of the first unit and at the end of the second unit.

Student Learning Measures

Students completed several assignments during the units. To measure student learning, results of tasks that were assigned to both the online and the face-to-face class were used. Five evaluations were used in this study:

1. Knowledge test. Students were administered a test with true-false, multiple choice, and matching items to measure their knowledge about fitness and nutrition before and after the study.

2. Goal-setting assignment. Students were provided instruction in a structured, goal-setting process, then asked to use the process to set personal fitness and nutrition goals. They were expected to use the results of a physical fitness test to set their fitness goals.

3. Fitness paper. After taking a physical fitness test, students wrote a paper that described their current fitness and physical activity levels. Then they used concepts from the goal-setting process to describe appropriate fitness goals and how to achieve them. If students did not set any fitness goals during the goal-setting assignment, they had to explain why in this paper.

4. Nutrition analysis. Students wrote a paper based on data of their current nutrition habits. They kept track of their diets for 3 days and inserted their diet data into the Dine Healthy program. Dine Healthy is a computer-based program that is used to analyze foods for nutrition type and caloric value. Students then wrote a paper evaluating and making recommendations to improve their nutrition habits based on the results of Dine Healthy.

5. Injury cases. Seven scenarios were presented in which an individual suffered an injury during physical activity. Students analyzed the scenarios and responded to questions about the type of injury suffered, treatment, and prevention.

Interviews

To examine how the online course was perceived, students in the online course were interviewed, as was the instructor of the course.

Students

Online students were interviewed in focus groups at the end of the fitness unit and the unit. Students were asked to identify what benefits they gained from learning the content online, what they did not like about learning online, and how the online learning could be improved. In addition, to gain as much feedback as possible, online students were encouraged to complete open-ended survey questions relating to their attitudes toward technology at the end of each unit.

Instructor

The instructor was interviewed four times during the course of the study, just before the unit started, after the fitness and after the nutrition units, and 3 weeks into the following semester. She was asked to respond to questions related to what she perceived

to be working or causing problems during the delivery of the online course, and how she felt about online instruction (what was *she* getting from implementing the study). In addition, she was asked to describe differences she perceived between the online and face-to-face class in terms of student attitude, work ethic, and knowledge, and student interactions with each other and herself. Since one researcher was present during the online course class delivery, informal observations regarding the instructor were also included in the analysis of instructor perceptions.

Data Analysis

Data from the student technology use survey for both the online and face-to-face class were tabulated and percentages for each item were generated. The student learning assignments in both the online and face-to-face classes were evaluated using the same scoring system. The knowledge test was scored according to the number of correct items out of a total of 15. The other assignments were assigned a point total and points were deducted from students' work for criteria not met. The goal-setting, fitness paper, and injury analysis assignments were worth 5 points each; the nutrition analysis was worth 10 points. Dependent *t* tests were conducted on the pretest and posttest scores to determine if significant gains in student knowledge were made. Independent *t* tests were used to compare the student learning results for the two classes.

Data from the interviews and informal observations were analyzed using the constant comparative method (Glaser & Strauss, 1967). Data were coded and analyzed into themes and categories, which were then used to organize the data (Bogdan & Biklen, 1992). To establish trustworthiness, both researchers made coding checks, interpretations, and assumptions independently and through discussion. An interobserver coding check revealed an 86-91% reliability agreement on coding categories. The researchers' interpretations of the instructor's perceptions were confirmed by the instructor.

Results

Student Background in Technology

All students except for one had access to a computer in their homes. The majority of students (92%, $n = 12$) indicated that they were able to perform basic operations on their computers like starting programs, using icons, and printing and saving documents. They used e-mail (85%, $n = 11$), typed research papers and used graphics (85%, $n = 11$), and created multimedia presentations (77%, $n = 10$), but were less likely to use graphs (54%, $n = 7$) and spreadsheets (46%, $n = 6$). The majority believed that knowing how to use the computer was important for their future (77%, $n = 10$). Students were asked about their attitudes toward technology before and after the units. Table 1 provides a summary of their perceptions. Their responses before and after the unitss did not indicate major changes in perceptions. The majority like to use technology; perceive that learning about technology is more important than learning about sports, art, or music; feel it is important for getting a job, and rate the value of technology highly. Thus, prior to participating in these units, most students were familiar with the use of technology on a regular basis.

Table 1

Attitudes Towards Technology

Questions	Pre-Post	Agree n	Don't know n	Disagree n
I don't like to use the computer.	Pre	0	3	9
	Post	2	2	8
I am more interested about learning about other subjects if I am able to use technology.	Pre	7	6	0
	Post	7	6	0
I do more homework outside of school if I am able to use technology.	Pre	8	3	2
	Post	4	6	3
I think that learning about technology is MORE important than learning about sports.	Pre	7	5	1
	Post	7	3	3
I think that learning about technology is MORE important than learning about art or music.	Pre	9	3	1
	Post	5	5	3
I think that using technology is important for getting a job.	Pre	8	3	2
	Post	8	4	1
I think the value of technology is overrated.	Pre	4	4	5
	Post	4	3	6
I would like to use technology more often.	Pre	7	3	3
	Post	7	6	0

Student Perceptions

Benefits

Student responses from both interviews concurred about the major benefits they perceived from learning content online. These were focused learning, pace of learning, and learning style preference.

Focused learning. Students indicated that learning online made them have to focus and pay attention to their learning. As one student said,

> The benefit...is that it's all up to you, you have to focus in on it, how much you need to get out of it, you have to go through each module yourself, and take in what you can and learn and put on web discussions. (Nutrition unit, #9)

This was expressed more after the first unit and less so in the second unit.

Pace of learning. Students perceived that online learning enabled them to focus on content, and allowed them to learn at their own pace and go back to review material when they wanted. They also thought that learning was easier and faster online, "that you don't have to take notes," and that learning face-to-face was harder. As one student stated, "I liked how we could go at our own speed, if we had a computer at home, I felt that if I had extra time I could do it outside of class and that was helpful" (Nutrition unit, #18). They liked the idea that they could work at home when they chose.

Learning style. For visual learners, this format was preferable, but for those who liked to work in groups or listen, this format became boring or made it hard to remember content. Overall, student responses to the first unit were favorable. However, responses for the second unit expressed more frustrations.

Difficulties

When asked what was hard about online learning, student responses were similar with regard to some aspects, while responses after the second unit were more numerous, specific, and more negative. As one researcher observed in her informal notes, the novelty of this form of learning had worn off or it could have been the break in this form of instruction that may have had a negative effect.

Navigation and organization. Common responses referred to the difficulties in learning to use the system, as well as the organization and design of the modules. Students were not used to this technology and needed constant individual assistance in using the technology, navigating through the modules (e.g., having to go back through the outline to get to certain content), and identifying important content in the first unit. As one student mentioned,

> Took a while to get the hang of it, going back and forth, what you are supposed to do, and where you are supposed to put what you are writing and things like that, you just had to get used to it. (Fitness unit, #8)

Students indicated that the directions for navigation and organization were difficult or confusing. Student suggestions for organization and navigation of the module were used to modify the nutrition module. Despite navigational and content specificity improvements that were made for the second unit, students still had concerns about how the content and assignments were organized. They felt that it took too long to get through the content.

Teacher and peer contact. Students perceived that they could not ask the teacher questions when they needed information. This was particularly frustrating when students needed words or content to be defined. Some students just preferred face-to-face contact, listening to a teacher, and the "riding" of the teacher to keep them on task. One student stated,

> I didn't like it because it seemed like the teacher was off limits, you were thrown in there to do it by yourself. I'm not that kind of learner, I need direction. I would much rather take notes, and have the teacher preach at me why I should be healthy, not just here, sit here and read. I felt stupid if I didn't understand something, and I would ask. In the classroom there were at least five other people that felt stupid, so you wouldn't be alone. Here it's more isolation... (Nutrition unit, #2)

Other students felt the need to compete with their neighbors in going through the modules. Some students mentioned that they missed the discussions and verbal interactions with their peers.

***Content*.** Student responses with regard to the depth of content were somewhat contradictory. On the one hand, some students felt that they knew most of the content while most of them were concerned that they did not know the content for evaluation purposes.

> I also think that it's kind of hard to make sure that you get everything done that the teacher expects. There wasn't a set amount of things you have to get done in a day, so its kind of making it up. I think it would be hard to take a test on the curriculum that we learned because a lot of it you did extra activities afterwards, but it was a lot of info and to read it was kind of confusing sometimes. (Fitness unit #14)

Students found some of the content too long, or they had to read too much. A few students indicated that in a face-to-face setting, the teacher would be able to discern how much students know and accelerate learning in the unit quickly, while when using online learning, the students had to keep reading until they got to something new. When asked if they were looking forward to going into a face-to-face setting, one student said,

> I think that it is going to be a lot more work, there will be a lot of note taking. We have to learn the same amount, but I will be able to retain the info better because I will be able to ask questions about what I don't understand and relate it to something. (Nutrition unit, #14)

Improvements

Not surprisingly, many suggestions for improvements related to the difficulties that the student expressed, while a few related to how online instruction should be used.

Content organization. As indicated, organizational and navigational changes were made for the second unit, but students were also concerned about what they should be learning. Most students concurred that quizzes, worksheets, and more time were needed to process and identify the information relevant to their evaluations. Shorter modules, use of more animations, highlighting of specific and important information, and links to more information or definitions would help them to learn the relevant information.

Role of the teacher. Most students indicated that the teacher needed to be more accessible for questions, and needed to keep them on track. Students needed the teacher to check their understanding and suggested that she hold review sessions.

Mixing instructional formats. Despite the difficulties identified, many students thought online learning was a good format when used with face-to-face formats. They perceived that the use of both formats would be interesting and motivating. However, they were not in favor of the use of an online only format. As one student stated,

> It would be better not to just do online and talking, but have a combination of both of them, so you can still ask questions, but if you don't like sitting there listening you can work online. (Fitness unit, #5).

Instructor Perceptions

Benefits

Prior to the start of the unit, the instructor perceived that online instruction would suit students who preferred learning in this format, while there were other students who would prefer face-to-face. After the unit, she felt that the perception still stood. In observing the students, she saw that the online format focused some students quickly, while other students either rushed through the modules without doing the work, or else became bored. The instructor thought that it was important for students to get used to working with computers or improving their technology skills in preparation for the real world. As she said,

> I think it hits kids' learning styles that we don't necessarily pay attention to their attention level. It will be real easy for some kids, and they will zip through it, it will be a challenge to keep them busy, and others it will be frustrating. I think it's good, like I told them the other day in class, there will be no jobs that they will have when they get out into the real world that are not going to include technology, it's time for them to get up to speed, and for me too.

From a personal standpoint, Ms. Riley was excited about the modules. The content was varied, and the online instruction presented students with different types of

assignments. She thought she could use the content in whatever instructional format she used in the future.

Concerns

Ms. Riley identified a number of concerns that are common when faced with a new format for teaching. They included student learning, student interactions, working with the technology, grading, and her changing role as a teacher.

Student learning. She felt that although there was little difference between the two formats in terms of student learning, the students in the online format had a harder time in knowing what to learn. She felt that this could have been made easier for them, through better communication on how they were to be evaluated.

During face-to-face instruction, she felt that she was able to quickly observe who understood the material, while in the online format, she had great difficulty in discerning who was having trouble learning. By the second module she was better able to monitor students she perceived to be having problems learning. She was also concerned about how to deal with students who had finished the modules. This was a concern expressed by one of the researchers who from her informal notes observed that many students raced through the slides and were not reading the content carefully. She felt frustrated by not knowing what work students had completed or how well.

When asked how students had changed when they moved back to the traditional face-to-face instruction after the units, Ms. Riley felt that the students quickly reverted to the traditional posture of receiving information, and letting the teacher control the learning format instead of searching for information and taking charge of their learning.

> I think that when they were in the classroom, their tendency was to sit back.... For the most part, it was back to normal, I (students) don't want to be challenged, I don't want to do something all the time. When they were online everyday, they had something to do and they got tired of that! As far as their work, I think the work they turned in was comparable before and after. The kids that were prone not to turn things in on time, didn't.

Student interactions. In a face-to-face format, instruction often includes strategies to promote a positive social climate. Ms. Riley observed that, within the online format, those strategies were difficult and used minimally. She was concerned that the students would not get to know each other. This did not prove to be the case; students appeared socially adept in the spring semester.

Working with the technology. Initially, students were frustrated by how to navigate through the program. Ms. Riley felt that she, as a novice, was not particularly helpful and that it was time-consuming. In addition, she felt that the navigational format hindered her ability in managing and grading the postings of the students.

Grading. Keeping up with student work was difficult and different than teaching in a face-to-face format. Ms. Riley felt that the management of the postings, and grading of student work needed daily monitoring and she was not used to doing this. As a result, she got behind and found this aspect to be overwhelming.

> I need to ask the kids, but I feel more disconnected from this group then I feel from my other's classes just because they are doing all this stuff on the computer and not asking questions in class. The questions they are asking, are about how do I get to this module, not necessarily questions about the info. So I feel more disconnected from them than the other classes.... I need to go through the journal postings, and I haven't dedicated time to do that yet, I need to start. Typically during my prep hour I'm doing a whole bunch of other stuff, I have a thousand other things to do, grading papers, but that's normal for me. I usually gather papers for weeks, then, spend a weekend grading them. With the online learning, maybe it's a benefit than a downfall, its going to force me to keep up a little more, there are some things that I need to respond to pretty quickly. That might be a benefit for me because it does stop my procrastination.

As she graded student work, she also felt that the quality of the student responses varied greatly and for some assignments was not as detailed as she got from the face-to-face students.

Changing role. Before the unit started, Ms. Riley was concerned about her role as a teacher. She perceived that the traditional power and control she had would be changed, but how? She was not sure what her role would be—would it be a facilitator? During the study she felt somewhat disconnected from her students. She missed the interactions with the students, and belatedly perceived that daily interactions online could improve this aspect.

Overall, after the study, Ms. Riley, felt that some of the content could be presented online. She wanted to have students do the assignments in a face-to-face format where she perceived she had more opportunities for quality control. From her experience, she felt that online instruction was a lot more work.

Student Learning

All students completed the pre and posttest for knowledge. The dependent *t* test on test scores showed a significant gain in student knowledge [$t(18) = 2.54$, $p < .05$] with an estimated magnitude of increase of 19% for the online group. The face-to-face also showed a significant gain in knowledge [$t(23) = 2.16$, $p < .05$] but a smaller magnitude of increase (14%). An independent *t* test conducted on the test results indicated that there was no significant difference between the groups in knowledge at the end of the unit [$t(40) = .57$, $p > .20$]. Table 2 presents the mean scores, standard, and *t* test results for the four assignments. Students who failed to complete the assignment received a score of zero and were not included in the statistical analysis. The only significant difference in student performance was in the fitness paper. Students in the face-to-face class tended to provide more precise information about their current fitness and physical activity levels and described more specific fitness goals and strategies to achieve them that did students in the online setting.

Table 2

Results of the Student Learning Assignments

Assignment		Online Group	Face-to-Face Group	*t* test
Goal Setting	M	4.56	4.33	$t(36) = 1.64$, $p = .08$
	SD	.38	.39	
Fitness Paper	M	4.04	4.71	$t(30) = 3.35$, $p = .004$
	SD	.72	.43	
Dine Healthy	M	8.20	8.82	$t(35) = 1.44$, $p = .15$
	SD	1.40	1.14	
Injury Evaluation	M	4.48	4.46	$t(36) = .12$, $p = .95$
	SD	.56	.45	

Discussion

The majority of students in this study reported their familiarity with the use of technology on a regular basis and valued the importance of technology in learning and gaining employment. This attitude did not vary significantly after the study. Since the use of technology is prevalent in the school, this finding is not surprising and is similar to findings from technology-enriched environment studies (Ayersman, 1996; Hopson et al., 2001-2002, Laumann, 2000).

The results of the study showed that when presented with different formats within which to learn, students' performance did not vary significantly. Both groups showed increased gains in knowledge. This is consistent with the research that compares delivery styles. In general, the research comparing the achievement of students in Web-based learning versus classroom-based learning indicates that there is no significant difference (Davies & Mendenhall, 1998). Despite this finding there are differences to be found in how students perceive an online instructional format.

The online instructional format proved to be of challenge to both the students and the instructor. The format shifted the responsibility of learning from the instructor to the student and required both the student and the instructor to take on new roles without much training or foresight (Gonzales & Sujo de Montes, 2001). Student perceptions provided glimpses of this constructivist shift. Students commented on how they enjoyed the flexibility with which they could determine their pace of learning, and how, as a result, they could focus more readily in creative ways. The format was popular with students who preferred this style of learning, as indicated in other studies (Gonzales & Sujo de Montes, 2001). On the other hand, students also struggled with the

responsibilities that came with this paradigm shift. They were torn between the flexibility that was allowed but desired the structure that most traditional face-to-face styles of delivery provide, like prompts and reminders from teachers, interactions with peers, handouts indicating what they will be evaluated on, and so on. Although students were provided schedule prompts and messages, more support could be provided with the use of scaffolding strategies, team projects, and debriefs (Loh & Williams, 2002). Students need structures that help them in this transition process. Navigational and organizational weaknesses found in the content format will further exacerbate any anxieties and frustrations with the learning process, and need careful planning and immediate remediation (Kim, Williams, & Dattilo, 2002). Future studies need to examine the process and stages that students at all ages encounter as they shift into a constructivist online format of instruction.

Similarly, the process instructors undergo is worthy of further research consideration. The instructor in this study, as most current instructors, has had little experience in planning and implementing technology in her classroom (Gallini & Barron, 2001-2002). As a result, she had difficulties and concerns about how to guide her students. Not being used to, nor familiar with ways she could use the technology to support her students, she was frustrated as to how to proceed (Weng, 2002). Coupled with this concern was her struggle with the paradigm shift from a centralized authority to a decentralized facilitator (Chin & Hortin, 1993-1994). Ms. Riley hovered between the persuasion and the decision stage (Rogers, 1995) during the study. She was willing to work with the researchers in implementing the technology, and explore its possibilities because she firmly believed that she needed to provide her students with the technology skills they need for the real world, and she saw that some students thrived with this instructional format. The level of time commitment and lack of perceived control or support for her students, however, was of major concern and raises the issue of facilitating the learning of using a constructivist student-centered format of teaching. If instructors traditionally use a teacher-centered approach in their teaching, then such a shift will be difficult to successfully implement. One suggestion might be to use a mixed-format approach (Gallini & Barron, 2001-2003). Both the instructor and the students concurred that their preference would be to include technology but with a more mixed approach in which there would be opportunities to interact with their peers and the instructor, face-to-face. This would also benefit students who do not prefer this learning format (Gonzales & Sujo de Montes, 2001). It seems apparent that both school and teacher preparation environments must take on the responsibility of supporting student-centered teaching approaches if the infusion of technology is to be wholly successful (Niederhauser et al., 1999).

Insights from this change process provided the researchers (and designers) and the instructor a number of suggestions and guidelines for initial and future implementation of online units that we thought would be useful to underscore. Many of them fall in line with the recommendations provided by Chickering and Gamson (1987) and Shneiderman (1992). For the students, we recommend the following: adding time to units for students to learn the system; creating opportunities for individualizing assignments and projects; providing some face-to-face time for review, feedback, and peer contact; clearly articulating how and what will be evaluated; and requiring some checkpoints. For instructors, we suggest planning work time differently, for providing feedback and

grading students' work. Instructors should prepare to change their role as teacher to one of facilitator. As expectations for instructors to integrate technology in their units increase, more support must be provided them so that they gain more experience and comfort with this process. A positive experience will more than likely result in instructors using technology more readily.

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