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Restructuring a University Health-Related Physical Activity Course with Technology: A Design-Based Research

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ABSTRACT

The purpose of this study was to investigate the restructuring process of a university health-related physical activity course with technology and its impact on teaching & learning practices. Using a design-based research approach, data were collected in five semesters by applying the technology integration strategies iteratively. Beginning with the needs assessment, the longitudinal study continued with the first and second pilots, and the process ended with improvements in the design and implementation phases. Data were collected through class observations, field notes, and interviews with the students and the instructor. Thematic content analyses were carried out with Nvivo software. Data and researcher triangulation were done for reliability and validity. Findings indicated that technology enhancement would contribute to the quality of health-related physical activity courses and the impact of technology integration was documented in detail. Implications and recommendations were given to stakeholders of the education environment; researchers, practitioners, administrators, technology coaches, and policymakers.

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INTRODUCTION

Universities have included health-related fitness (HRF) courses and physical activity classes in their curriculum encouraging undergraduate students to develop healthy lifestyles and positive attitudes toward lifelong physical activity for a couple of decades (Hensley, 2000; Kulinna et al., 2009; Corbin et al., 2020). An HRF course usually focuses on providing students with the knowledge and skills related to four components: (1) body composition, (2) cardiovascular endurance, (3) muscular strength & endurance, and (4) flexibility (American College of Sports Medicine - ACSM, 2014). Research supported that gaining HRF knowledge improved the physical activity levels of university students (Ferkel et al., 2014; Maldari et al., 2021; Zhang et al., 2016). An HRF course also improved 'students' physical, psychological, and emotional well-being (Annesi, et al., 2017; Li et al., 2009). Since offering HRF courses in university are essential, the content and design of these courses should be evaluated. Keating et al. (2012) indicated that the focus of HRF courses at the university level remained on just mastering knowledge. According to Strand et al. (2010), nearly half of the HRF courses offered in USA universities are web-enhanced, and their effectiveness in ensuring students learning is not studied enough. However, Milroy et al. (2013) found that students with higher perceived psychological, emotional, intellectual, and social wellness prefer online and blended HRF courses rather than face-to-face HRF courses.

The design of HRF courses has been increasingly influenced by emerging health-related fitness technologies and instructional technologies. For example, heart rate monitors, pedometers, accelerometers, GPS watches, multimedia technologies (Mohnsen, 2012), and recently mobile apps have provided physical education teachers with a wide range of options to enrich their classes and create authentic learning experiences (Roth, 2014). Physical activity monitors offer opportunities for students to track and monitor their fitness levels (Ransdell et al., 2008). Also, web-based tools have evolved in the last decade to a more collaborative and efficient form. At first, the World Wide Web, also called web 1.0, was used to provide information. Later on, web 2.0 emerged, a platform where people could collaborate, create and publish their information using social media, blogs, wikis, and other media platforms (Jimoyiannis et al.,2013). This innovation in web technologies leads teachers to use web 2.0 tools within their classrooms, often to enhance learning and teaching (Wankel & Blessinger, 2013). Integrating online learning experiences with face-to-face class meetings have provided rich environments for meaningful learning (Garrison & Vaughan, 2008). This type of instructional design is also called web-enhanced instruction or blended learning. With

appropriate planning and support, blended learning could lead to an encouraging transformation for faculty development and students' satisfaction with their learning experiences (Moskal et al., 2013). To effectively organize and administer online course information and assignments, universities provide online delivery mediums also referred to as Learning Management Systems (LMS) (Luke & Morrissey, 2014).

Designing, developing, implementing, and testing technology-enhanced lessons can be a substantial challenge (Marttinen et al., 2019). As Armour et al. (2020) emphasized a digital challenge addressing to support young people for health and physical activity with an expectation to change the content and the pedagogy to meet their needs. Baert (2011) found that Physical Education Teacher Education (PETE) faculty did not feel confident in using technology, often have low proficiency and integration levels, and used primarily traditional computer technologies. Technology coaches have an essential role in supporting instructional environments. Sugar (2005) found that technology coaches helped teachers to gain confidence in using technology in their classrooms. Baran et al. (2013) mentioned that reshaping the higher education 'teachers' perspectives on technology integration, listening to their views, giving the teachers a participatory role, and using their experiences appeared to be critical when enhancing their online teaching practices.

The researcher of this study selected a physical activity course in a metropolitan university in Turkey and questioned the extent to which online instruction should be combined with traditional instruction, how technology could support course activities, and which technology should be selected when deciding on appropriate instructional strategies. The university physical activity course that is mentioned focused on developing healthy behaviors and promoting lifelong physical activity, and it has shown positive effects on undergraduate students. Various theoretical perspectives were used to investigate the impact of this course. For example, a social cognitive theory-based intervention was carried out to develop self-regulatory skills, social support, and self-assessment of health-related fitness (Ince, 2008). The exercise stages of the change model were investigated to understand the health-promoting behaviors of individuals at various physical activity levels (Ince & Ebem, 2009). And lastly, the trans-contextual model was used to understand individuals' autonomous behavioral control over leisure-time physical activity (Muftuler & Ince, 2015). The results showed increased health-promoting behaviors (e.g., nutrition behavior, health responsibility, social support, stress management), physical activity engagement, and perceived autonomous support for leisure time physical activity.

To implement the appropriate strategies based on students' needs and to be able to design a technology-enhanced HRF course, a framework such as Technological Pedagogical Content Knowledge (TPACK) can be used (Koehler & Mishra, 2009). The design-based research (DBR) approach was believed to be the perfect fit for monitoring and evaluating the process of designing a technology-enhanced course. A DBR approach can gain insight into how technology has influenced the university HRF course, the teacher, and the students. Even though teachers' understanding, evaluating, and developing TPACK skills have been studied substantially, knowledge of which design principles should be considered to restructure and develop a university physical activity course remains scarce. The flexibility offered by the DBR can provide insight into which elements should be noted for technology integration, what impact they have on this process, and which barriers they create. Therefore, the purpose of this study was to investigate the design process and the impact of restructuring a university Health-Related Fitness course with technology. The following questions were addressed:

1. What are the design principles for restructuring a university HRF course with technology?

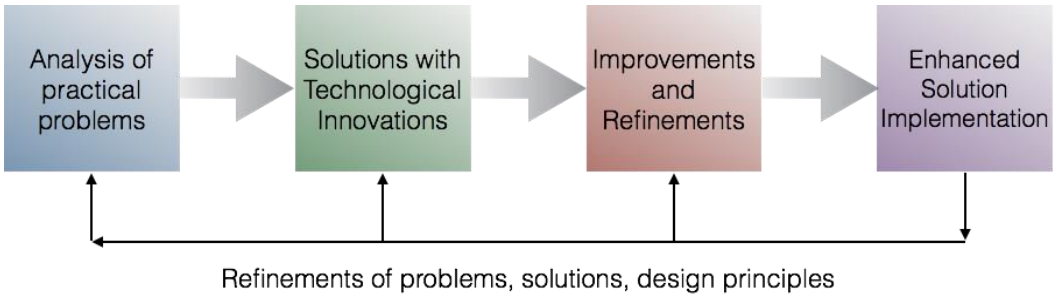
2. What were the challenges when restructuring a university HRF course with technology?

3. What was the impact of restructuring the University HRF course with technology on students and the instructor?

METHODS

Based on the experiences of a university instructor about the issues he faced in a current HRF course, this research used a DBR approach that focused on restructuring the design of a university HRF course with technology. The main focus of the study was to offer the instructor solution-oriented strategies that met his teaching needs and investigated the impact of technology-integrated HRF courses on students' and the instructor's experiences. DBR is defined as *"an emerging paradigm for studying learning in context through the systematic design and study of instructional strategies and tools"* (Design-Based Research Collective, 2003, p. 5). As shown in Figure 1 below, DBR starts with an analysis of practical problems. It continues with solutions and refinements of these solutions until the enhanced solutions are implemented. It is an iterative process and can repeat the cycles as needed.

Figure 1
Design-Based Research

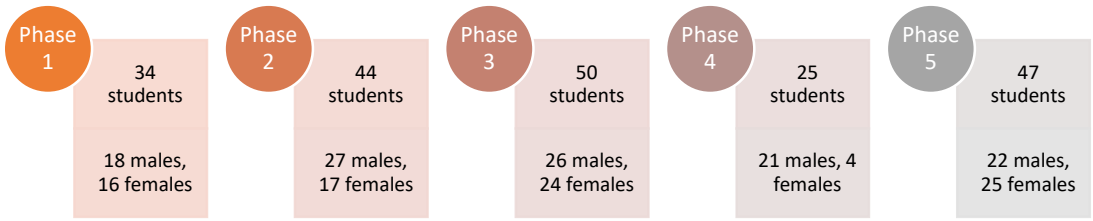


During these iterations, there are certain decisions to be made to form, improve, change, and apply the instructional designs one after another semester, respectively. The design elements emerge during and after this process (Van den Akker et al., 2006). The literature portrays two general types of DBR (Richey et al., 2004; Wang & Hanafin, 2005). In Type I DBR, activities are performed to evaluate a specific product or a program design. On the other hand, a Type II DBR focuses on the design, development, or evaluation processes. Therefore, to determine design principles and understand their impact on teaching and learning practices, this study can be categorized as a Type II DBR. Additionally, with a focus on understanding the impact of an instructional design on students and the teacher, this study is qualitative in nature. Understanding the world as it is, discovering the beliefs and motivations of certain individuals reflectively, and documenting an education environment that has various social interactions, qualitative research was selected as a way of the design of the study. In an attempt to answer questions about participants and context, understand the participants' perspective, and in-debt analysis of an unknown phenomenon, qualitative research is considered very useful (Patton, 2002).

Study Group

Throughout five semesters, 200 university students (114 males, and 86 females) participated in the study (Figure 2). With the convention of research ethics about participants, the real identities were confidential within this research. The researcher was the assistant for the first four semesters. Only the last semester, there was one more course assistant. Hence the researcher concentrated on the video recording of the classes as a participant observer. The instructor who had 20 years of field experience, offered the classes. The students from various departments with different backgrounds had taken the course as an elective course in their program.

Figure 2
Participants



Data Collection Tools

Re-designing process of the HRF course with technology had taken a complete five phases. Beginning with a needs analysis, an online medium between the instructor and the students were considered useful for the course. In the second phase, A Facebook group was created and tested to serve the online course medium role. However, according to the views of the instructor and researcher's field notes, the Facebook group was not maintained for the following semesters. Instead, a Learning Management System (LMS), an online course management system provided by the university, was chosen as a course medium in the 3rd, 4th and 5th phases of the study. Certain technologies were added to the course in each phase. For example, a tablet PC was provided to the instructor to help with classroom management. Lots of course materials were digitalized as e-portfolios. Online discussions were created and managed in LMS to increase collaborative learning. Some classes were recorded with a camera and attached to the LMS for student use. GPS-based mobile applications were used for tracking and promoting physical activity. Heart-rate monitors allowed students to understand the object by living and experiencing it. Exergame with XBOX Kinect used in a dance class for motivational purposes.

Data Analysis

The researcher's field notes and, reflection reports, interviews with the instructor and students were used as the primary sources of data collection. Throughout the five phases of the study, the researcher collected qualitative data and managed it with QSR NVivo 11 software (Table 1). All the documents were analyzed with a thematic analysis approach, which is explained by Willig (2013, p. 178) as a "method for recognizing and organizing patterns in content and meaning in qualitative data". Various descriptive codes were identified within the documents. The codes are assembled into categories and subcategories, which lead them to themes. In the end, specific themes emerged for answering research questions.

Table 1
Phases of the Study

Dates	*Phases*	*Procedures*	**Data (Number of Documents)**
2012-2013 Spring Semester	Needs Analysis	Observation of the learning environment and determining the course-related problems	Field notes (1), Expert opinion (1)
2013-2014 Fall Semester	First Pilot Study	Testing Facebook as a course medium, online collaboration, podcasts, and online videos. Tablet PC for the instructor.	Field notes (1), Instructor Reflections (1)
2013-2014 Spring Semester	Second Pilot Study	Testing LMS as a course medium with the digitalization of course materials. Recording and sharing lab sessions. Mobile application for students.	Field notes (1), Instructor Reflections (1)
2013-2014 Summer School	Improvements of Design	Refinements of the course design by adding online communication and collaboration. Exergaming (XBOX).	Instructor Reflections (1), Instructor Interview (1), Student Interviews (6), Student Online Surveys (12)
2014-2015 Fall Semester	Design Implementation	Improved LMS interface. Heart-rate monitors & accelerometers. Webinars. Class videos.	Field notes (1), Instructor Reflections (1), Students Reflections (3), Student Interviews (6)

Trustworthiness

Both the data triangulation and the investigator triangulation were used to provide trustworthiness in this research. In order to triangulate the findings, various sources were used for data collection. Concerning the quality and accuracy of the data that was gathered, data triangulation was used by combining different data sources in an attempt to answer research questions consistently. Patton (2002, p.554) indicates data triangulation as "*comparing and cross-checking the consistency of information derived in different times and by different means*". Those are expert opinions, interviews with instructor and students, researcher's field notes, instructor and students' reflections, and students' open-ended surveys derived from different times throughout five different periods (phases as the researcher dubbed it). For the investigator triangulation, the researcher had continuous discussions and negotiations with another specialist in the physical education field to create and refine the codes separately and then together. The data was reviewed line by line, and eventually, specific themes emerged with mutual understanding for the inter-coder reliability (Miles & Huberman, 1994).

Researcher's Role

Developing the standards of excellence with technology for students, teachers,

administrators, coaches, and computer science educators, the International Society for Technology in Education (ISTE) defines the skills, knowledge, and goals for teaching and learning with technology (ISTE, 2015). Being a technology coach, the researcher acted in the current research according to the second standard of ISTE Standards for Coaches (ISTE, 2015); which is "Teaching, Learning, and Assessments": "*Technology Coaches assist teachers in using technology effectively for assessing student learning, differentiating instruction, and providing rigorous, relevant, and engaging learning experiences for all students.*"

In the current research, for the needs of a university physical education instructor in Turkey to transform his lesson into a more effective form, the researcher generates a variety of solutions by employing different instructional approaches integrated with technology. The researcher, a Ph.D. candidate during the data collection, first observed the field and took notes on the problems that the instructor confronted. Beginning with a needs analysis, the university HRF course was restructured in line with the problems. The researcher was responsible for monitoring and recording the class, taking notes about the whole instruction process, conducting interviews, and collecting and analyzing the data. The Instructor was assisted and supported by the delivery of a technology-oriented environment. There was no involvement from the researcher in any instruction processes throughout the semesters.

RESULTS

Research Question 1

What are the design principles for restructuring the university HRF course with technology? After the needs assessment in the first semester, five design principles were applied from the second semester to the end of the fifth semester. Throughout this time, certain decisions had taken into consideration according to the needs and perceptions of the instructor and the students.

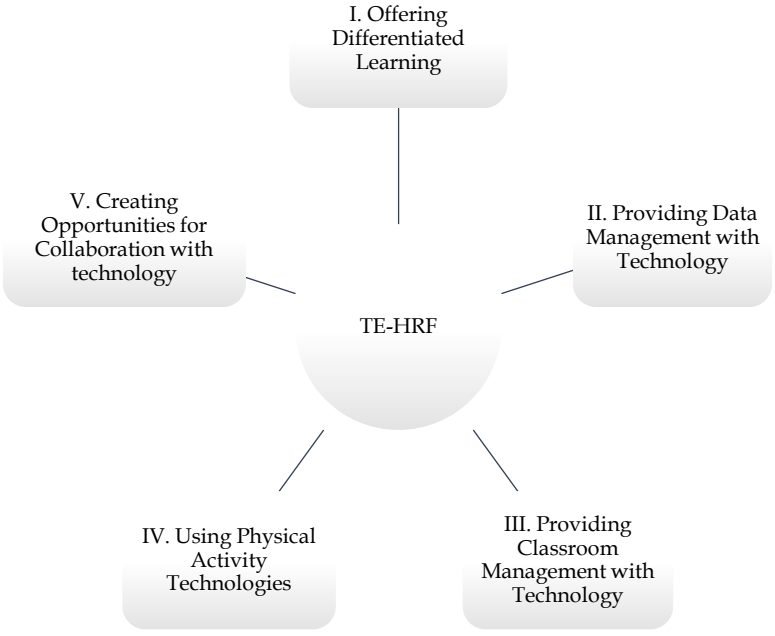
An expectation for an online platform to be integrated into the course had emerged within time as the instructor mentioned the exhaustion and boredom of lecturing in Phase 1: *"I get bored doing lecturing. I do lecturing for 5 hours. It's meaningless. On the other way, you shall tell just check this, read the questions and come again, with only 5 minutes of lecturing, right?"* The paper consumption and managing all the course materials were also other issues: *"We are consuming too much paper. Managing this much paper is also very difficult. I am sick of storing the portfolios in my room."*

According to the researchers' field notes, after determining and creating an online delivery medium (LMS), online content was improved and organized. The researcher

digitalized the portfolio materials on LMS. The portfolio comprised 40% of the course grades, and it required the students to prepare it at the end of the semester. The interface of the LMS has improved with posters week by week, which showed the location and date of the classes. More videos were added (the Introduction video and Lab video were recorded and uploaded, exercise physiology video was shared). Physical activity-related technologies also became an important facet of the course as a mobile GPS tracking application (Endomondo), and exergaming (XBOX Kinect) were added to the course activities besides pedometers. The instructor started to use a Tablet PC to record the movements and give instant feedback. Through the end of the semester, students were categorized according to their physical activity stage, and webinars were organized with these groups separately.

The course activities were thought, created, and matched those five design principles mentioned below (Figure 3). Each course activity includes at least one design principle. With the possibility that the other characteristics might be recognized in different research findings, the principles derived from the literature are considered the most decisive components for restructuring a university health-related physical activity course with technology.

Figure 3
Technology-Enhanced Health-Related Fitness Course Design Principles



The first principle is offering differentiated learning. Technology integration can help teachers to differentiate or individualize the learning process according to the learners' readiness level and personal needs (Davies et al., 2013; Harris et al., 2009). Relevant technologies chosen for specific pedagogical purposes allow teachers to understand each

individual with critical feedback. The second principle is data management with technology. Students value learning management systems as they can monitor and control their educational progress (Chung & Ackerman, 2015). The third principle is providing classroom management with technology. Educational technology skills are directly related to classroom management skills in literature (Bester & Brand, 2013; Varank & Ilhan, 2013). Technology affects classroom management by computing grades, tracking attendance, communicating with students, and storing course-related content (Emmer et al., 2013). The fourth principle is using physical activity technologies. There are lots of emerging technologies that can be used to promote physical activity, such as pedometers (Cayir et al., 2015), physical activity trackers (Diaz et al., 2015), and heart rate monitors (Ignico & Corson, 2006). The fifth principle is creating opportunities for collaboration with technology. Working together to improve and gather knowledge via technology has great potential (Carroll et al., 2013; Goodyear et al., 2014; Junco et al., 2013). Learning Management Systems also enables instructors to present course-related information to students and let them engage in forums, discussions, and chats (Romero et al., 2008). The design principles-related course activities are presented below (Table 2).

Table 2
Design Principles Matched with Course Activities

Design Principles	Course Activities with technology
1. **Offering Differentiated Learning**	Online Assignments on LMS, heart rate monitor, pedometer, web-based sources
2. **Providing Data Management with Technology**	Using LMS for the course medium, Online Assignments on LMS
3. **Providing Classroom Management with Technology**	Using LMS for the course medium, Digitalization of the hardcopy materials, Instructor used Tablet PC
4. **Using Physical Activity Technologies**	Using pedometers, mobile app (Endomondo), Exergaming (XBOX Kinect), heart rate monitor, accelerometers
5. **Creating Opportunities for Collaboration with Technology**	mobile app (endomondo), online forum on LMS, webinar

Research Question 2

What were the challenges when restructuring the university HRF course with technology?

The thematic content analysis of expert opinions, student and instructor interviews and reflections, field notes, and open-ended online student surveys revealed five main challenges encountered during the restructuring process. These were 1) Ethical Considerations, 2) Attitudes toward Technology, 3) Need for Technology Helper, 4) Need for Time to adapt, and 5) University Policies for Technology Integration.

As for attitude toward technology; although there was a need and will to integrate technology in his HRF course, the instructor raised concerns about the quality of the course at the beginning of the process: "*The quality of this course is already at a certain level. When we integrate technology into the course, where will be the position of the course?*"

On the other hand, students' attitude toward technology is another challenge faced during the technology integration process. The uncertainty of whether or not the students watched the videos and what they could get from them raised another issue as Student 7 reflects in Phase 2: "*I think the face-to-face class is more effective. There were two videos, and I do not remember the videos 90 percent. I just remembered the video, and there was something about the treadmill.*"

For the ethical issues; specific considerations can be seen in the researcher's field observation as quoted in Phase 1: "*A Facebook Group for the health-related physical activity course was created. Yet, there were some students who hesitated to combine their personal life and academic life. This raised ethical issues.*"

On the other hand, the researcher observed discomfort among some students last semester due to having a camera taking shots in the gym or weight room. Additionally, since the problems occurred viewing LMS in different browsers, the videos about classes had to be uploaded on YouTube. Although these videos were hidden, there were questions from students about if the videos and the pictures on LMS might be seen by any other person out of the class or not. There have been some issues that emerged as the technology integration process carried on. These issues were mainly around device management and software issues, and accessibility. The instructor claimed in the last phase that having an assistant for technological devices could be convenient:

> "*It seems difficult to walk with a tablet PC and take notes. Last year, I tried it in a few classes, and I saw that it would not be that difficult. If you can know when to take the tablet PC in your hand and when you put it back, and if you have a helper like an assistant, I understood that it would work.*"

On the other hand, when providing lots of technological devices to students, managing those emerged as another issue. One of the assistants, for instance, prepared a name list, and the students signed this list when they took and brought back the devices. Still, according to field notes from the fall of 2014-2015, two pedometers were lost. The Instructor pointed out another important issue about the need for a helper that the technology assistant should know the context:

"The responsible individual should know the gym environment since we are going there for the classes, and I do not think that an individual from outside of this context can give this service. It is important the existence of the sport-related technologies but also the environments related to sports."

University strategies for technology integration are another important topic. As an expert opinion, providing tech support to instructors should be taken into consideration:

"Every instructor in the university should have a technology supervisor. I mean, it is the kind of person who helps to design technology-integrated courses. Essentially, this position should be created and supported by the CEIT (Computer Education and Instructional Technology) departments of the universities. If such positions do not exist, there is no chance of following the emerging developments in the instructional technology area."

The instructor also stated in the phase 4 that the role of architects when designing gyms and the role of the university in the professional development of its staff:

"Gyms are not constructed well according to technology integration, and the architecture is not flexible to changes, and the staff, too. We saw these as instructors and newly started to argue about it, and the management of the university is not aware of such needs. Even though our school has a good wireless Internet system, the gyms are not covered well."

The researcher pointed out an important consideration about time and effort to create and sustain online materials in the beginning. According to the researcher's field notes in Phase 3, s DBR provides flexibility, digitalizing the course materials and designing the LMS as a course delivery medium took a while: "The digitalization of the course materials took considerable time and effort. Once created, they can be copied, improved, and used for the upcoming semesters but still, creating and developing the online materials takes time." A need for an adaptation period was emphasized by another student in phase 4:

"The content is loaded I mean you can see a lot of details, but still there is a structure that is confusing to me. Therefore, I did not go into it other than my needs like where is what, etc. Maybe it's just because of me, I don't know."

In the upcoming semester in Phase 5, the instructor also mentioned the focal points for the adaptation period: *"Firstly, understanding the technology itself, then meet it with the content of the class and understand how to use it meaningfully, later on applying it. All of these processes need a certain amount of time."*

Research Question 3

What was the impact of restructuring the university HRF course with technology on students and the instructor?

As a result of the thematic content analysis of expert opinions, student and instructor interviews and reflections, researcher's field notes, and open-ended online student surveys revealed, a total of 5 themes emerged: 1) Classroom Management, 2) Data Management, 3) Differentiated Learning, 4) Motivation and 5) Workload.

During the restructuring process, one of the most significant impacts is classroom management. As expert opinion noted as: "*The focus would be describing the process more than the result. In-debt study of a design is the point. What happens if the classroom ecology is changed? Affordances of technology for certain pedagogy and content are crucial.*" The instructor reflected on an issue about recognizing students and matching related feedback with them without missing any:

"*Even if I do not know their names, there is a system created now to be able to take notes about students. Within an application on this Tablet PC, I can take notes for a student for specific things, which helps me not forget feedback about them personally.*"

The LMS spread out the portfolio items throughout the weeks by the researcher. Instructor attributes this issue in Phase 4:

> "*Obtaining the product files part by part each week, which I took at the end of the course previously, is beneficial for me. You know, to understand how is the class going, what is their level, which direction are they going, got easier.*"

The students also gave positive feedback for having the semester week by week before their eyes online in Phase 5: "*The information about where the class is and which topic will be was prepared quite fun and nicely with illustrations.*" For the benefits of having an online medium for classroom interaction, another student in Phase 5 stated his thoughts as:

> "*I think it has a big plus for communication with the instructor and the class because, in other classes, we generally don't have much communication with the instructor. They give lectures and go. There is also few things on the Internet. Therefore, I think it improves our connection with the instructor and let us get to know our friends more easily and visually. I think it was beneficial.*"

As for data management, the answers to the questionnaires helped the instructor to behave accordingly. For instance, the most preferred physical activities from students were already shown in LMS. The students who have health problems have shown there too. The

physical activity stages of students also can be seen on LMS. How many of them are on the preparation or contemplation stage at a physical activity level. They were all statistically ready and stored online after students filled out the questionnaires. The instructor was happy to see all the information about every individual online in Phase 5:

> *"When students answer online the tools and materials, I can have transcriptions about each individual. With this, it takes a huge burden off my shoulders. Ahmet or Ayşe, it is personally identifiable data. When s/he enters the data, the elements that I should focus on are coming to me with already analyzed."*

Students used the advantage of having their data online as student 6 in Phase 5 said:

> *"I checked my previous physical activity programs to see what I wrote and compare them. Then, I wrote a program accordingly. It was good to write after checking my drawbacks. Because I happened to monitor my improvement in the semester. I saw what I want to do."*

As for differentiated learning, previously, the instructor had to give students lots of feedback on their heart rates, like "slow down!" or "go a little bit faster!" to reach or stay in the heart rate zones. On the other hand, now, we can see each student continuously checking their heart rate monitor watches, and they are all around in the gym separately while doing their activity. Heart rate monitors made the learning experiences individual. The Instructor reflected in Phase 3 as: "*I effectively used individual feedback. It worked well… Based on the self-reflection reports (from the portfolio materials) I learned the needs of each individual.*" A GPS-tracking physical activity application called Endomondo was promoted in the class. The students had their individual learning opportunities as Student 4 in Phase 4 said:

> *"Then, when I used Endomondo, it was given information like how much distance I ran and how much water an average person loses. The nice thing was you could arrange a pace like how you can run for a certain amount of time. For example, when I was running around the house, I did it on 2 min 10 sec. But in Endomondo, I was checking the clock and knew that one tour is 400 meters long. I saw that I ran 6min for a km. A mobile application like Endomondo serves the purpose well."*

The Instructor's motivation can be seen in Phase 2 during the reflection and interview on consecutive semesters for using tablet PC and LMS:

> *"I liked Tablet PC. I need some time to try it at the gym and look at how it makes me feel walking around with a tablet pc in my hand as a teacher. Within an application on this*

Tablet PC, I can take notes for a student for specific things. That helps me not to forget feedback about them personally."

Some activity classes were recorded and uploaded on LMS to let the students watch themselves. Lots of them enjoyed themselves and had fun watching themselves on videos. They said that they could identify their mistakes, or it's good to see them from the outside in an activity. Student 3 in Phase 5 reflected as:

"The videos about our activities were fun. Opening it and laughing at us is fun. I watched the activity videos with my roommates and commented, "oh god how bad I played or I could not catch this ball" But it was nice I had a lot of fun."

According to the Instructor's view in Phase 5, using exergaming was one of the most fun parts of this course:

"I saw that some students try to escape from rhythm education. I assume that some students will think and try to explore exergames in their life after we successfully use them in the gym. I saw such benefits, and these were not decreased the motivation of the students."

During the restructuring process, whether it brings extra workload or not is another issue for the Instructor's point in Phase 4:

"I asked someone to set up the XBOX Kinect in a dance class. I am thinking if I spend that amount of energy doing it myself. Because it is an extra workload like whether the technological tool works or not, make you vacant or not… For instance, if the speaker is not working effectively or if there is no electricity these can be problematic. The batteries of the heart rate monitors can run out so I should check all of them. I cannot say this lesson does not solve my needs but new problem areas appeared."

Student 11 from Phase 4 also pointed out the same issue as follows:

"I think the workload of the course is appropriate. Even when filling out the forms, we have information about many topics for our physical conditions. Since these forms were designed not to take so much time of students, it does not make any difficulties."

DISCUSSION

The Health-Related Fitness course that was mentioned to be integrated with technology was normally designed to make university students become familiar with fundamentals in health, wellness, and fitness concepts. The instructor used a limited number of technological devices, such as a body fat analyzer (bio-impedance) and pedometers in the

traditional class. There were eight main intended outcomes (cognitive, affective, and psychomotor) for the course:

1. Understand the relationship between health, wellness, and physical fitness.
2. List the fundamentals of health-related physical fitness.
3. Comprehend the basic anatomy, exercise physiology, and exercise psychology knowledge.
4. Practice and evaluate health-related physical fitness tests.
5. Choose the correct methods to improve physical fitness based on personal needs.
6. Practice different physical activity choices.
7. Be a critical consumer of physical education and sport.
8. Appreciate physical fitness and healthy lifestyles.

Assessment procedures include portfolios (i.e. Resting Heart Rate and Blood Pressure, Caloric Intake Record), fitness tests (i.e. 20 m shuttle run, 1 min. Sit-up and push-up), and mid-term & final exams.

Restructuring a university physical activity course with technology and its impact on students and the instructor was the main focus of current research. With the help of physical activity technologies such as heart rate monitors, pedometers, and mobile applications, students reported having their own feedback highlight the offered differentiated learning opportunities. Students reported that they could check their previous physical activity goals and their current situation on LMS. Keating et al. (2012) found that physical activity goal setting and planning were only included in approximately one-third of the schools which offer physical activity courses in the USA sample. They also suggested that most physical activity courses remain at the knowledge level; however, solving students' daily life problems should be the focus. With the instant and continuing feedback from physical activity technologies like heart rate monitors and smartphone applications, students also reported connecting the knowledge they learned in class to normal life situations. Goodyear et al. (2019) stated that wearable apps and mobile applications help young people to learn about health-related issues.

The instructor in the current study was highly satisfied with the student-specific feedback from LMS. One of the things that made the instructor happiest was that all things went online, and all the hardcopy materials piled up at the instructor's office were gone. The instructor was also happy for another reason: he did not have to read and analyze all the assignments anymore because as soon as students completed and submitted the online assignments, they were already analyzed and categorized before his eyes on LMS. Literature

was also in line with these findings, as teachers were reported to be able to differentiate or individualize the learning process according to the learners' readiness level and personal needs (Davies et al., 2013; Harris et al., 2009; Rosen & Beck-hill, 2012). Data management and classroom management with technology were one of the main advantages of this study. Chung and Ackerman's (2014) findings were also parallel with this study as they stated that students valued LMS because they can monitor and control their educational progress. Dias & Diniz (2014) also mentioned that the most significant advantage of LMS was its content repository feature, as it involves documents, slides, study notes, and subject contents in one medium.

Technology affects classroom management in several ways, such as computing grades, tracking attendance, communicating with students, and storing course-related content (Emmer et al., 2013). Online physical activity courses could decrease seat time and allow students to be more active (Sargent & Casey, 2020; Strand et al., 2010). Still, one of the instructor's hesitations in the current research was decreasing the course quality. However, results showed technology integrated health-related physical activity courses offered already analyzed and categorized data to the instructor whenever the students do their assignments. The more educational technology teachers demonstrate, the more classroom management skills they have (Bester & Brand, 2013; Varank & Ilhan, 2013). Students reported their satisfaction with the online forum on LMS to get to know people in the class. They also liked the online videos of classes to see each other from an outside perspective. LMS has also offered students to check how they were doing throughout the semester. Chou and colleagues (2010) stated that students could monitor and track their progress through course management systems. The instructor mentioned the importance of the webinar that he administered last semester according to the physical activity levels of students. Literature was also in line with these aspects as it emphasized the potential of collaboration to improve and gather knowledge via technology (Carroll et al., 2013; Goodyear et al., 2014; Junco et al., 2013) and engagement in forums, discussions, chats (Romero et al., 2008).

Attitudes toward technology both from the instructor and the students emerged as a challenge. The instructor's hesitation in decreasing the course quality and dissatisfaction with using Facebook as a medium was among the first notable issues. Baert's findings (2011) were parallel with this result as most of the physical education faculty in the USA did not feel confident in using technology, they often have low proficiency and integration levels, and they remain using mostly traditional computer technologies. Ertmer et al. (2012) also have similar findings that existing attitudes and beliefs toward technology and current levels of knowledge

and skills are the most substantial barriers to preventing teachers from using technology. Although social media could be used as a medium for an informal tool to provide HRF knowledge (Goodyear & Armour, 2021) some of the students didn't want to combine their personal life and academic life with using Facebook for educational purposes in this research. The instructor also mentioned his displeasure with using Facebook as he thought it was a little bit informal and may cause problems. Similarly, in literature, while students reported that Facebook is important for socialization in university and can be integrated into education, some faculty members thought Facebook is not suitable for educational purposes (Madge et al., 2009; Roblyer et al., 2010).

In order to overcome the problems that the instructors experienced, listening to their views, giving them a participatory role, and using their experiences appeared to be critical to reshape the higher education teachers' perspectives on technology integration (Baran et al., 2013). University instructors need technical support because they think digital tools are complex (Schoonenboom, 2014). Benson and Ward (2013) evaluated three professors' teaching expertise through the lens of the TPACK framework. They found that technological knowledge alone is not enough for developing TPACK skills. One should have adequate pedagogical knowledge first (Birch and Burnett, 2009). Adopting the technology integration process required time. Creating and organizing the online content took time. University policy for technology integration was raised as another issue. As universities provide online delivery mediums for organizing and administering online course information and assignments (Luke & Morrissey, 2014), support mechanisms should also be developed for blended learning opportunities such as organizational infrastructure, faculty development, and course development (Moskal et al., 2013). Research showed that training instructors for LMS make them more assessment and grade-oriented (Chow et al., 2018). Also, the role of social influence and ease of use are significant factors for the acceptance of an LMS by university instructors (Garone et al., 2019).

Motivation was another theme that emerged from the findings. Research with GPS devices indicated that acceptability and ease of use rates were high, and wear-related concerns were low. The young participants with higher education backgrounds found that the GPS device made the study enjoyable (Zenk et al., 2012). Sun (2012) stated that although it is questionable to increase the physical activity of children, exergames could help to improve physical activity motivation. Douglas and his colleagues (2019) also reported that e-portfolios affect higher education students' confidence and motivation. Workload emerged as another area in which the technology-integrated health-related physical activity course impacted.

Milroy and colleagues (2013) found that students prefer online lifetime physical activity and wellness lectures rather than face-to-face courses. They suggested that instructional activities could be designed accordingly. Hence, university students can be challenged in online lectures more. Sidman and colleagues (2011) found that students select online physical activity courses to balance their social responsibilities and work. The academic workload was found to be one of the barriers since adopting and integrating technology in education takes time (Birch & Burnett, 2009). However, online technology integration with physical activity courses should be carried out carefully because most of the students and instructors concentrate more on the enjoyment of the class while improving health and wellness than on online assessments and assignments (Beaudoin, et al., 2018). Cerezo and colleagues (2016) investigated the learning management system interaction patterns of 140 undergraduate students, and they defined four different patterns with two categories named Task-oriented groups (socially focused & individually focused) and Non-Task-oriented groups (procrastinators & non- procrastinators).

CONCLUSION

During the Covid-19 pandemic, the digital spaces for learning expanded from schools to homes. As more evidence is needed for the connection between learning outcomes and digital spaces (Kraftl et al., 2022), current research would help stakeholders to understand the technology and education relationship. The results of the current research shed new light on restructuring the traditionally designed university physical activity courses with technology. The potential of the design principles in this research for the instructor and the students can be a good example for other university physical activity classes. All the stakeholders in the university physical education setting can benefit from the implications of this research. As the current study emphasized, the main challenges that were faced during the restructuring process such 1. Attitudes toward Technology (Instructor's and Students' attitudes), 2. Ethical Considerations (Confidentiality), 3. Need for Tech Support (Accessibility, Device Management, Software Issues), 4. Need for Time to adapt (Adaptation Period), and lastly, 5. University Policies for Technology Integration (University Regulations) should be considered.

Additionally, the impact of re-designing A HRF course with technology contributed to 1. Classroom Management (Classroom Interaction, Planning, Teaching Strategies), 2. Data Management (Cost-effectiveness), 3. Differentiated Learning (Using technology to understand the content, Meaningful Feedback), 4. Motivation (Students' and Instructor's motivation, appreciation for technology) and 5 Workload (Instructor's and Students' workload).

In conclusion, the restructuring process with technology was successful. The transition from traditional learning to the blended learning environment in a university health-related physical activity context constitutes a valuable example.

Limitations

In qualitative research, researcher bias is considered one of the main threads of the studies. In the current research, this thread was decreased to the minimum by implementing the triangulation technique to analyze the data. Another thread in qualitative research is researcher might be perceived as intrusive and disruptive by the participants, and the environment can be affected by this situation. The researcher was the course assistant throughout the five semesters in the role of participant observer. According to the reflections with the instructor, students were thought to embrace the researcher as a natural part of the class (Creswell, 2014).

The findings of qualitative research can represent only a small part of a context and cannot be generalized to the population. The focus of qualitative research is transferability, rather than generalizability, essentially. Whether the findings of certain research could be applied to different settings. The strength of this type of research is that it helps to understand the -debt of a phenomenon (Patton, 2002). Being longitudinal research spread out over five semesters, repeated interviewing with the same person (Instructor) threads the study as changing his behavior, yet it gives an in-depth and comprehensive understanding of the process (Creswell, 2014).

PRACTICAL IMPLICATIONS

Regarding the results of this study, there are certain implications as follows:

1. A total of five design principles for a technology-enhanced health-related physical activity course was generated as an example for counterparts and stakeholders.
2. The impact of a technology-enhanced health-related physical activity course was shown.
3. Physical activity technologies are influential for students to promote and motivate for physical activity.
4. Instructor's job got easier with a technology assistant beside a course assistant.
5. Students can manage, monitor, and follow their progress with a well-designed course medium

Authors' contributions

Authors were involved in all sections of the present research; including the stages of writing, data collection and analyses, discussion, and revision.

Conflict of interest declaration

To the author's concerns, there is not any conflict of interest in this study.

REFERENCES

ACSM (2014). *ACSM's Health-Related Physical Fitness Assessment Manual (4thed)*. Philadelphia: Walters Kluwer Health/Lippincott Williams & Wilkins Health.

Annesi, J. J., Porter, K. J., Hill, G. M., & Goldfine, B. D. (2017). Effects of instructional physical activity courses on overall physical activity and mood in university students. Research *Quarterly for Exercise and Sport*, 88(3), 358-364. https://doi.org/10.1080/02701367.2017.1336280

Armour, K. M., Goodyear, V. A., & Sandford, R. (2020). *The digital age challenge: preparing physical and health educators to understand and support "online" youth. In School Physical Education and Teacher Education* (pp. 92-102). Routledge.

Baert, H. (2011). *The integration of technology within physical education teacher education: Perceptions of the faculty*. (Dissertation) University of Arkansas.

Baran, E., Correia, A.P. & Thompson, A. (2013). Tracing successful online teaching in higher education: voices of exemplary online teachers. *Teachers College Record Volume* 115(3), 1-41. https://doi.org/10.1177/016146811311500309

Beaudoin, C., Parker, T., Tiemersma, K., & Lewis, C. (2018). Evaluating university physical activity courses from student and instructor perspectives. *Journal of Physical Education, Recreation & Dance*, 89(1), 7-11. https://doi.org/10.1080/07303084.2017.1390508

Benson, S. N. K., & Ward, C. L. (2013). Teaching with technology: Using TPACK to understand teaching expertise in online higher education. J*ournal of Educational Computing Research,* 48(2), 153–172. https://doi.org/10.2190/EC.48.2.c

Bester, G., & Brand, L. (2013). The effect of technology on learner attention and achievement in the classroom. *South African Journal of Education*, 33, 1–15.

Birch, D., & Burnett, B. (2009). Bringing academics on board : Encouraging institution- wide diffusion of e-learning environments Institutional context for the Research. *Australasian Journal of Educational Technology*, 25(1), 117–134. https://doi.org/10.14742/ajet.1184

Carroll, J. A., Diaz, A., Meiklejohn, J., Newcomb, M., & Adkins, B. (2013). Collaboration and competition on a wiki: The praxis of online social learning to improve academic writing and Research in under-graduate students. *Australasian Journal of Educational Technology,* 29(4), 513–525. https://doi.org/10.14742/ajet.154

Cayir, Y., Aslan, S. M., & Akturk, Z. (2015). The effect of pedometer use on physical activity and body weight in obese women. *European Journal of Sport Science*, 15(4), 351-356. https://doi.org/10.1080/17461391.2014.940558

Cerezo, R., Sanchez-Santillan, M., Paule-Ruiz, M. P., & Nunez, J. C. (2016). Students' LMS interaction patterns and their relationship with achievement: A case study in higher

education. *Computers and Education*, 96, 42–54. https://doi.org/10.1016/j.compedu.2016.02.006

Chow, J., Tse, A., & Armatas, C. (2018). Comparing trained and untrained teachers on their use of LMS tools using the Rasch analysis. *Computers & Education*, 123, 124-137. https://doi.org/10.1016/j.compedu.2018.04.009

Chung, C., & Ackerman, D. (2015). Student Reactions to Classroom Management Technology: Learning Styles and Attitudes Toward Moodle. *Journal of Education for Business*, 90(4), 217–223. https://doi.org/10.1080/08832323.2015.1019818

Corbin, C. B., Kulinna, P. H., & Yu, H. (2020). Conceptual physical education: A secondary innovation. *Quest*, 72(1), 33-56. https://doi.org/10.1080/00336297.2019.1602780

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Method approaches (4th ed.)*. SAGE: Los Angeles.

Davies, R. S., Dean, D. L., & Ball, N. (2013). Flipping the classroom and instructional technology integration in a college-level information systems spreadsheet course. *Educational Technology Research and Development*, 61(4), 563–580. https://doi.org/10.1007/s11423-013-9305-6

Design-Based Research Collective. (2003). Design-based Research: An emerging paradigm for educational inquiry. *Educational Researcher,* 32(1), 5–8. https://doi.org/10.3102/0013189X03200100

Dias, S. B., & Diniz, J. A. (2014). Towards an enhanced learning management system for blended learning in higher education incorporating distant learners' profiles. *Educational Technology & Society*, 17(2), 307-319. https://www.jstor.org/stable/jeductechsoci.17.1.307

Diaz, K. M., Krupka, D. J., Chang, M. J., Peacock, J., Ma, Y., Goldsmith, J., Davidson, K. W. (2015). Fitbit®: An accurate and reliable device for wireless physical activity tracking. *International Journal of Cardiology*, 185, 138—140. https://doi.org/10.1016/j.ijcard.2015.03.038

Douglas, M. E., Peecksen, S., Rogers, J., & Simmons, M. (2019). College Students' Motivation and Confidence for ePortfolio Use. *International Journal of ePortfolio*, 9(1), 1-16. https://eric.ed.gov/?id=EJ1214509

Emmer, E., Sabornie, E., Evertson, C. M., & Weinstein, C. S. (2013). *Handbook of Classroom Management: Research, Practice, and Contemporary Issues.* Taylor & Francis.

Ferkel, R.C., Judge, L.W., Stodden, D.F. & Griffin, K. (2014). Importance of health-related fitness knowledge to increasing physical activity and physical fitness. *The Physical Educator*, 71, 218-233. https://js.sagamorepub.com/pe/article/view/2813

Garone, A., Pynoo, B., Tondeur, J., Cocquyt, C., Vanslambrouck, S., Bruggeman, B., & Struyven, K. (2019). Clustering university teaching staff through UTAUT: Implications for the acceptance of a new learning management system. *British Journal of Educational Technology*, 50(5), 2466-2483. https://doi.org/10.1111/bjet.12867

Garrison, D. R. & Vaughan, N. D. (2008). *Blended learning in higher education: framework, principles, and guidelines.* Jossey-bass: San Francisco, CA.

Goodyear, P., Jones, C., & Thompson, K. (2014). *Computer-Supported Collaborative Learning: Instructional Approaches, Group Processes and Educational Designs.* In M. J. Spector, D. M. Merrill, J. Elen, & J. M. Bishop (Eds.), *Handbook of Research on Educational*

Communications and Technology (pp. 439–451). New York, NY: Springer New York. doi:10.1007/978-1-4614-3185-5_35

Goodyear, V. A., & Armour, K. M. (2021). Young People's health-related learning through social media: What do teachers need to know?. *Teaching and Teacher Education*, 102, 103340. https://doi.org/10.1016/j.tate.2021.103340

Goodyear, V. A., Armour, K. M., & Wood, H. (2019). Young people learning about health: the role of apps and wearable devices. *Learning, Media and Technology*, 44(2), 193-210. https://doi.org/10.1080/17439884.2019.1539011

Harris, J., Mishra, P., & Koehler, M. (2009). Teachers' Technological Pedagogical Content Knowledge and Learning Activity Types : Curriculum-based Technology Integration Reframed. *Journal of Research on Technology in Education*, 41(4), 393–416. https://doi.org/10.1080/15391523.2009.10782536

Hensley, L. (2000). Current status of basic instruction programs in physical education at American colleges and universities. *Journal of Physical Education, Recreation, and Dance*, 71(9), 30-36. https://doi.org/10.1080/07303084.2000.10605719

Ignico, A., Corson, A., & Vidoni, C. (2006). The effects of an intervention strategy on children's heart rates and skill performance. *Early Child Development and Care*, 176(7), 753-761. https://doi.org/10.1080/03004430500232615

Ince, M. L. (2008). Use of a social cognitive theory-based physical-activity intervention on health-promoting behaviors of university students. *Perceptual & Motor Skills*, 107(3), 833–836. https://doi.org/10.2466/pms.107.3.833-836

Ince, M. L., & Ebem, Z. (2009). Role of exercise stages in self-reported health-promoting behaviors of a group of Turkish adolescents at transition to university. *Perceptual & Motor Skills*, 108(2), 399-404. https://doi.org/10.2466/pms.108.2.399-404

ISTE. (2015). *International Society for Technology in Education (ISTE) Standards: Learning, teaching and leading in the digital age.* Retrieved May 20, 2015, from http://www.iste.org/standards.

Jimoyiannis, A., Tsiotakis, P., Roussinos, D. & Siorenta, A. (2013). Preparing teachers to integrate web 2.0 in school practice: toward a framework for pedagogy 2.0. *Australasian Journal of Educational Technology*, 29(2), 248-267. https://doi.org/10.14742/ajet.157

Junco, R., Elavsky, C. M., & Heiberger, G. (2013). Putting twitter to the test: Assessing outcomes for student collaboration, engagement and success. *British Journal of Educational Technology*, 44(2), 273–287. https://doi.org/10.1111/j.1467-8535.2012.01284.x

Keating, X. D., Wallace, J., Schafer, J., O'Connor, M., Shangguan, R., & Guan, J. (2012). Analyses of higher education conceptual physical education courses. Journal of Research in Health, *Physical Education, Recreation, Sport & Dance*, 7(2), 38-44. https://eric.ed.gov/?id=EJ993568

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge. *Contemporary issues in technology and teacher education*, 9(1), 60-70. https://www.learntechlib.org/primary/p/29544

Kraftl, P., McKenzie, M., Gulson, K., Accioly, I., Blackmore, J., Burke, C., Clarke, D., Daniels, H., Fregoso Bailon, R. O., Goodyear, P., Goodyear, V., Gunasekara, I., Hartong, S., Hickman Dunne, J., Howard, S., Lupinacci, J., Mcphie, J., Mannion, G., Nxumalo, F., ...

Wood, A. (2022). *Learning spaces: built, natural and digital considerations for learning and learners.* In S. Bugden, & G. Borst (Eds.), *Education and the learning experience in Reimagining education: The International Science and Evidence based Education Assessment* (pp. 452-547). https://mgiep.unesco.org/iseeareport

Kulinna, P.H., Warfield, W.W., Jonaitis, S., Dean, M. & Corbin, C. (2009). The progression and characteristics of conceptually based fitness/wellness courses at American universities and colleges Journal of American College Health, 58(2), 127-131. https://doi.org/10.1080/07448480903221327

Li, G.S.F., Lu, F.J.H., & Wang, A.H.H. (2009). Exploring the relationships of physical activity, emotional intelligence and health in Taiwan college students. *Journal of Exercise Science & Fitness*, 7(1), 55-63. https://doi.org/10.1016/S1728-869X(09)60008-3

Luke, J.K. & Morrissey, J.L. (2014). Integrating online pedagogy into kinesiology: service learning for kinesiology majors. *Kinesiology Review*, 3, 258-262. http://dx.doi.org/10.1123/kr.2014-0064

Madge, C., Meek, J., Wellens, J., & Hooley, T. (2009). Facebook, social integration and informal learning at university: It is more for socializing and talking to friends about work than for actually doing work. Learning, *Media and Technology*, 34(2), 141–155. https://doi.org/10.1080/17439880902923606

Maldari, M. M., Garcia, J. M., & Rice, D. J. (2021). The impact of health education on physical activity correlates in college students. *Journal of American College Health*, 1-6. https://doi.org/10.1080/07448481.2021.1879812

Marttinen, R., Daum, D., Fredrick III, R. N., Santiago, J., & Silverman, S. (2019). Students' perceptions of technology integration during the FIT unit. *Research Quarterly for Exercise and Sport*, 90(2), 206-216. https://doi.org/10.1080/02701367.2019.1578328

Miles, M. B., Huberman, A. M. (1994). *An Expanded sourcebook: Qualitative data analysis.* (2nd edition). Thousand Oaks, California: SAGE Publications, Inc.

Milroy, J. J., Orsini, M. M., D'Abundo, M. L., & Sidman, C. L. (2013). College Students' Perceived Wellness Among Online, Face-to-Face, and Hybrid Formats of a Lifetime Physical Activity and Wellness Course. *American Journal of Health Education*, 44(5), 252–258. https://doi.org/10.1080/19325037.2013.807754

Mohnsen, B. (2012). *Using Technology in Physical Education (8th ed.).* Bonnies Fitware Inc.

Moskal, P., Dziuban, C., & Hartman, J. (2013). Blended learning: A dangerous idea? *Internet and Higher Education,* 18, 15–23. https://doi.org/10.1016/j.iheduc.2012.12.001

Müftüler, M., & İnce, M. L. (2015). Use of trans-contextual model-based physical activity course in developing leisure-time physical activity behavior of university students. *Perceptual and Motor Skills*, 121(1), 31–55. https://doi.org/10.2466/06.PMS.121c13x1

Patton, M. Q. (2002). *Qualitative Research and Evaluation Methods (3rd ed.).* Sage Publication: Thousand Oaks.

Ransdell, L.B., Rice, K., Snelson, C. & Decola, J. (2008). Online health-related fitness courses a wolf in sheep's clothing or a solution to some common problems? *Journal of Physical Education Recreation and Dance*, 79(1), 45-52. https://doi.org/10.1080/07303084.2008.10598119

Reeves, T. C. (2006). *Design research from a technology perspective.* In J. van den Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds.), Educational design research (pp. 52-66). London: Routledge.

Richey, R.C., Klein, J.D. & Nelson, W.A. (2004). *Development research: Studies of Instructional Design and Development.* In D. Jonassen, Handbook of Research for Educational Communications and Technology (2nd ed., pp. 1094-1130). Hillsdale: NJ: Lawrence Erbaum Associates.

Roblyer, M., McDaniel, M., Webb, M., Herman, J., & Witty, J. (2010). Findings on Facebook in higher education: A comparison of college faculty and student uses and perceptions of social networking sites. *The Internet and Higher Education*, 13(3), 134–140. https://doi.org/10.1016/j.iheduc.2010.03.002

Romero, C., Ventura, S., & García, E. (2008). Data mining in course management systems: Moodle case study and tutorial. *Computers and Education*, 51(1), 368–384. https://doi.org/10.1016/j.compedu.2007.05.016

Rosen, Y., & Beck-hill, D. (2012). Intertwining digital content and a one-to-one laptop environment in teaching and learning: Lessons from the time to know program. *Journal of Research on Technology in Education*, 44(3), 225–241. https://doi.org/10.1080/15391523.2012.10782588

Roth, K. (2014). Technology for Tomorrow's Teachers. *The Journal of Physical Education, Recreation & Dance*, 85(4), 3–5. https://doi.org/10.1080/07303084.2014.884420

Sargent, J., & Casey, A. (2020). Flipped learning, pedagogy and digital technology: Establishing consistent practice to optimise lesson time. *European Physical Education Review*, 26(1), 70-84. https://doi.org/10.1177/1356336X19826603

Schoonenboom, J. (2014). Using an adapted, task-level technology acceptance model to explain why instructors in higher education intend to use some learning management system tools more than others. *Computers and Education*, 71, 247–256. https://doi.org/10.1016/j.compedu.2013.09.016

Sidman, C.L., Fiala, K.A. & D'Abundo, M.L. (2011). Exercise motivation of college students in online, face-to-face, and blended basic studies physical activity and wellness course delivery formats. *Journal of American College Health*, 59(7), 662-664. https://doi.org/10.1080/07448481.2010.524683

Strand, B., Egeberg, J., & Mozumdar, A. (2010). Health-related fitness and physical activity courses in US colleges and universities. *Journal of Research in Health, Physical Education, Recreation, Sport & Dance*, 5(2), 17-20. https://eric.ed.gov/?id=EJ913327

Sugar, W. (2005). Instructional technologist as a coach: Impact of a situated professional development program on teachers' technology use. *Journal of Technology and Teacher Education*, 13(4), 547. https://www.learntechlib.org/primary/p/4888/

Sun, H. (2013). Impact of exergames on physical activity and motivation in elementary school students: A follow-up study. *Journal of Sport and Health Science*, 2(3), 138–145. https://doi.org/10.1016/j.jshs.2013.02.003

Van den Akker, J., Gravemeijer, K., & McKenney, S. (2006). Introducing educational design research. *In Educational Design Research* (pp. 15-19). Routledge.

Varank, I., & Ilhan, S. (2013). The Effects of Teachers' Educational Technology Skills on Their Classroom Management Skills. *Online Submission*, 3(4), 138-146. http://dx.doi.org/10.13054/mije.13.60.3.4

Wang, F. & Hanafin, M.J. (2005). Design-based research and technology enhanced learning environment. *Educational Technology Research and Development*, 53(4), p.5-23. https://link.springer.com/content/pdf/10.1007/BF02504682

Wankel, C., & Blessinger, P. (2013). *Increasing student engagement and retention in e-learning environments: Web 2.0 and blended learning technologies (Vol. 6)*. Emerald Group Publishing.

Willig, C. (2013). *Introducing Qualitative Research in Psychology 3rd ed.* McGraw-Hill, NY.

Zenk, S. N., Schulz, A. J., Odoms-Young, A., Wilbur, J., Matthews, S. A., Gamboa, C. & Stokes, C. (2012). Feasibility of using global positioning systems (GPS) with diverse urban adults: Before and after data on perceived acceptability, barriers, and ease of use. *Journal of Physical Activity & Health,* 9(7), 924. https://doi.org/10.1123/jpah.9.7.924

Zhang, T., Xiang, P., Gu, X., & Rose, M. (2016). College students' physical activity and health-related quality of life: An achievement goal perspective. *Research Quarterly for Exercise and Sport*, 87(2), 182-190. https://doi.org/10.1080/02701367.2016.1159279