Concussion Awareness Education:

A Design and Development Research Study

by

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A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Approved April 2016 by the
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ARIZONA STATE UNIVERSITY

May 2016

ABSTRACT

This research study looks at the design and development of an online concussion awareness education module. The Keep Your Head in the Game: Concussion Awareness Training for High School Athletes, or Brainbook, is a stand-alone e-learning module designed to run for fifty minutes and to be highly interactive using short video clips with associated comments as well as polling features to allow students to experience the content as they are learning. It was designed to provide the instruction through a framework that resembles social networking to increase relevance and engagement to the high school student-athlete population it was created for. The content is delivered through the presentation of an online conversation or a "feed" where characters with varying attitudes towards concussion, with contributions from a doctor and professional athlete, discuss concussions from their experiences and beliefs. The instructional goals of the module are to increase the athletes understanding and personal application of the causes and effects of concussions, and to motivate a change in attitude and behavior related to the perception, recognition, and care of head injuries. The design and development of this online educational module followed the tenets of design and development research as determined by Richey and Klein (2007), where the tasks of completing the design and development of the product were combined with studying the process. The study focused on what could be learned during the phases of design and development, identifying challenges that were encountered designing education that resembles social networking, testing the effectiveness of the module in relation to meeting the instructional objectives, and creating guidelines and best practices that contribute to the field of instructional design.

This design and development project was found to be a success by the design team, the client, and outside entities. Findings of the study include a breakdown of the most impactful decisions made by the design team in the design and development process, the results of the team member and client interviews to provide additional insight into the process, and results from the student athlete post-module design and attitude surveys informing if attitude change indeed occurred as a result of this educational intervention. Brainbook also received much coverage in the media and has progressed on to version 2.0, additional measures of success of the project.

DEDICATION

With so much love and appreciation I want to dedicate this dissertation to my family and friends who had patience, offered encouragement, and loved me all along the way.

First, to my parents who helped to drive me across the country to pursue this degree, who listened to my worries, celebrated my triumphs, who continuously pushed (even when I didn't think I wanted to be pushed) me, and who believed in me, thank you.

Second, to my brother and sister who taught me about love, support, and have given me such joy in watching how beautifully their lives have evolved. It's a true joy to be your big sister.

Third, to my dear friend Dr. Angie Koban, who not only embodies the type of woman I want to be like by completing this degree, but who also continuously offered support, another set of eyes, encouragement, and who cheered for me to become a Ph.D.

ACKNOWLEDGMENTS

To my co-chairs, Dr. Wilhelmina Savenye and Dr. Brian Nelson, who graciously agreed to support me in completing this study and my doctoral degree after it was already underway and for providing incredible feedback, support, and encouragement all throughout. Also, to Dr. Angela Barrus, who has been a wonderful classmate, colleague, mentor, and finally committee member as I've completed this degree.

To Dr. James Klein who warmly welcomed me into this doctoral program, started as my chair on this project, and encouraged me all along the way to finish this journey.

I also want to recognize and deeply thank the team that I worked with on this project for it would not have been such a success without all of them and their incredible work. To Dr. Angela Barrus, Dr. Quincy Conley, and Robert Christopherson, thank you for your wonderful contributions and for teaching me so much from your work.

Lastly, to Dr. Javier Cardenas, who put out the call for request for proposals that our team assembled and responded to. It was a pleasure to work with him and his colleagues to develop Brainbook.

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CHAPTER 1

INTRODUCTION

Injury in sport has always been a concern for those participating, watching, and coaching. A sports-related injury receiving considerable attention recently is concussion. From the National Football League (2013) implementing stricter guidelines for when an athlete can return to play to several states regulating concussion awareness education and "return to play" guidelines, concussion awareness has quickly become an important topic among athletes, parents, physicians, coaches, trainers, and educators. There are more than 38 million youth participating in sport in the United States, and concussion is one of the most commonly reported injuries (CDC, 2008). Because of the prevalence of concussions and the dangers that they bring to youth playing sports, there is a need to educate athletes on what the signs, symptoms, treatment, and dangers of concussion are. With 38 million youth participating in sport as mentioned above, it becomes a difficult task to get this important information to each of them. For this research study an online concussion awareness education module was designed and developed. The Keep Your Head in the Game: Concussion Awareness Training for High School Athletes, or Brainbook, is a stand-alone e-learning module designed to run for fifty minutes and to be highly interactive using short video clips with associated comments as well as polling features to allow students to experience the content as they are learning. It was designed to provide the instruction through a framework that resembles social networking to increase relevance and engagement to the high school student-athlete population it was created for. The content is delivered through the presentation of an online conversation or a "feed" where characters with varying attitudes towards concussion, with

contributions from a doctor and professional athlete, discuss concussions from their experiences and beliefs. The instructional goals of the module are to increase the athletes understanding and personal application of the causes and effects of concussions, and to motivate a change in attitude and behavior related to the perception, recognition, and care of head injuries.

The design and development of this online educational module followed the tenets of design and development research as determined by Richey and Klein (2007), where the tasks of completing the design and development of the product were combined with studying the process. The study focused on what could be learned during the phases of design and development, identifying challenges that were encountered designing education that resembles social networking, testing the effectiveness of the module in relation to meeting the instructional objectives, and creating guidelines and best practices that contribute to the field of instructional design.

Concussion Prevalence

The diagnosis, treatment, and recovery of mild traumatic brain injury or more commonly known as concussion, has received much recognition as a major public health concern (Kelly, 1999). At the high school level in the United States approximately 60,000 concussions occur annually, with 63% occurring in football (Powell, 1999). In a study by Field, Collins, Lovell, and Maroon, high school and college athletes who suffered a concussion underwent neuropsychological testing after the injury and were compared to their uninjured peers (2003). It was found that high school athletes who had suffered a brain injury had prolonged memory dysfunction compared to college athletes

who had suffered brain injury and performed significantly worse than their age-matched peers at seven days after the injury (Field et al., 2003). The population of interest in the proposition and subsequent creation of the concussion awareness education module is high school student athletes in the state of Arizona. With the number of student-athletes in the state reaching 100,000, getting this information to all these athletes posed the next consideration in design and development.

Health Behavior Change

Health Behavior Change Delivered via the Internet. In combining the large population that the online concession module, Brainbook, is to reach, the age of the population, and the goals of not only knowledge acquisition, but also health behavior change, the internet offers a great modality to accomplish the task. According to Roberts and Foehr (2008), internet-delivered health behavior change interventions could be particularly suitable for young adults and adolescents since they grew up with the internet and are likely more open to the possibilities it affords. Bernhardt and Hubley (2001) also state that the internet holds the promise to reach large numbers of people and is a suitable modality to deliver interventions aimed at primary prevention of physical chronic disease through health behavior change.

In a meta-analysis conducted by Crutzen, Nooijer, Brouwer, Oenema, Brug, and de Vries (2011) aimed at internet-delivered health behavior change, strategies to facilitate exposure to the instructional material were analyzed. In exploring which methods and strategies were used to facilitate exposure they found that nine of the interventions studied customized their information to a certain extent (Crutzen et al., 2011). Nine

interventions supported their participants through either professionals or peers (Crutzen et al., 2011). Several strategies were employed as far as delivery of the intervention's content (Crutzen et al., 2011). Five interventions provided content in an interactive way and in four interventions content was made easily accessible through a simple linear design (Crutzen et al., 2011). Two interventions made use of progressive presentation of the content so that users could not move on until they viewed the previous component (Crutzen et al., 2011). Another strategy used in three interventions was to link the intervention to a relevant social context for the learners (Crutzen et al., 2011). These strategies for content presentation and facility are important considerations for the design of an internet-based module for concussion awareness. In designing Brainbook the developing team used the above recommendations in the approach to allow for a seemingly customized experience (like/dislike interactions and comment selection) that presented the content through conversations between characters who resembled the student-athletes' peers and professionals (doctor and professional athletes). There was also attention given to the progressive presentation of the content and emulating an experience that resembled potential social interactions they might have or be familiar with.

Health Behavior Change in Adolescents via the Internet. Crutzen, Nooijer, Brouwer, Oenema, Brug, and De Vries (2009) introduced a conceptual framework for understanding and improving adolescents' exposure to internet-delivered interventions. They state that exposure, or paying attention, to the content in addition to active use and the elaboration of the components of the intervention are necessary prerequisites to health behavior change (Crutzen, et al., 2009). Exposure in internet-delivered interventions can

be defined as (1) accessing the intervention, (2) staying on the intervention long enough to use and process the intervention, and (3) revisiting the intervention website (Crutzen, et al., 2009). The last item refers only to interventions that were designed to be visited multiple times. "Long enough" is difficult to define since it depends both on the intervention and the individual (Crutzen, et al., 2009). In creating their conceptual framework they focused on adolescent and young adult populations because many health-risk behaviors are acquired during adolescence and because adolescents without any chronic disease are unlikely to be internally motivated to seek out health promotion and behavior change interventions (Crutzen, et al., 2009). Added to the above-mentioned commonality among adolescents having grown up with the internet, this opens new possibilities for this medium to be used in behavior change interventions because interactions can be built into the education to increase the students' exposure and attention to the intervention. Lastly, the internet behaviors of adolescents differ from those of adults since adolescents tend to use the internet for instant messaging, gaming, downloading, and visiting social networking sites, whereas adults primarily use the internet for email and information seeking (Crutzen et al., 2009). These factors in addition to design and development considerations led to the creation of the conceptual model (Crutzen, et al., 2009). In designing and developing for this population it is also important to consider factors that relate to how that population learns, especially their social context. Consequently, in the design of the concussion awareness module the team chose to design the interface to resemble social networking as a way to connect with the audience by emulating a familiar social context, providing opportunities for interaction with the instruction, and presenting the content in a variety of ways.

Social Learning Theory

Social Learning Theory addresses how social and personal competencies can evolve out of the social conditions within which learning occurs (Bandura, 1977). Analysis and understanding of the learner's social context is an important component of creating instruction that will promote and sustain behavior change (Moisey, 2001), and is thus a key activity for designing an online module focused on changing health-related behavior. An important consideration in effecting behavior change is to create a supportive social and instructional environment where learning occurs (Moisey, 2001). The first strategy to accomplish this is to create a "normalizing" experience where course content, examples, and activities suggest that the possible changes that the learner may be experiencing with self-concept or emotional reactions are "normal" and that others share their experiences (Moisey, 2001). The second strategy to be employed here is to identify barriers. Ask what barriers are present in the learner's environment that may be hindering them from achieving the desired behavior. Barriers can range from lack of support, to personal beliefs and attitudes, to social and environmental behaviors (Moisey, 2001). Examination of these barriers should take place and then instruction should address these barriers through content, activities, and support (Moisey, 2001). The third strategy suggested by Moisey is to build on existing social supports (2001). The factors that exist in ones environment that could support behavior change should be considered. Once those factors have been identified the instruction should be designed to capitalize on those assets to help foster their learning and behavior change. The fourth recommendation in regard to designing instruction using the Instructional Systems Design (ISD) model combined with Social Learning Theory is to develop social skills in

your learners (Moisey, 2001). Learning how to behave appropriately in a new situation or how to modify behavior in a familiar situation must also be considered in the design of the instruction. Students should be provided with examples and activities to help them understand the social skills needed to demonstrate the desired behavior. Often people are hesitant to act on a new behavior because of fear of embarrassment, not knowing what to expect, or not knowing how to act. Another important strategy is inducing self-efficacy in the learners (Moisey, 2001). Bandura (1977) defines self-efficacy as addressing the learner's conviction that they can successfully execute a behavior, and involves the prediction of how successful they will be in carrying out the behavior. There are two suggested ways to induce self-efficacy in learners. One is to use live modeling and the other is to use symbolic modeling. This may include using examples that emphasize the advantages of carrying out the desired behavior or using personal testimonials, both of which are aimed at persuading students that they too can be successful at carrying out the desired behavior (Moisey, 2001). The team made considerations in the design of Brainbook based on these findings. The social networking framework provided an opportunity to leverage symbolic modeling where examples of social interactions around the topic of concussion could be presented. This "normalizing" experience was achieved through the characters in the module that much of the content was presented, via online conversations or the feed. The characters (Healthy Hank, Paranoid Pete, Show-off Sally, and Daredevil Dan) represented a range of attitudes towards concussions and their sport. This allowed the student-athletes to encounter the different perceptions of concussions and connect it to their experiences and how they might address concussions moving forward.

Stages of Change Framework. The third theoretical framework in the integrated instructional design approach is the stages of change framework along with the concept of readiness for change (Moisey, 2001). This is particularly aimed at how people change health-related behaviors. The stages of change framework includes five stages that people pass through in the change process. According to Moisey (2001), each stage is defined and has specific tasks that must be completed before people move to the next stage. In the pre-contemplation stage, people have no desire to change their behavior and typically deny that there is a problem. The goal in this stage is to make the individual aware of their behavior and the most effective strategy that can be employed to accomplish that is to make the individual aware of the risks and problems with their current behavior. The next stage is contemplation and in this stage people acknowledge that there may be a problem but have not yet taken action on it. The goal here is to give the learner information about the problem including its causes, risks, pros and cons, and the possible solutions. In the next stage of preparation people are planning to take action but are unsure of how to do so. The goal then becomes helping the person develop a plan for action. In the action stage people are actually changing their behavior. In this stage, it is important to provide encouragement and support. In the final stage of this model, maintenance, the individual battles against lapses or relapses in their new behavior. It is important to provide stabilization to the individual in their new behavior (Moisey, 2001). While considering these factors for designing and developing education with the goal of health behavior change, it is also important to consider the basic tenets and steps of instructional design.

Instructional Design

In Dick, Carey, & Carey's (2001) systematic model of instructional design the following steps are involved: (1) assess needs to identify goal(s), (2) conduct instructional analysis, (3) analyze learners and contexts, (4) write performance objectives, (5) develop assessment instruments, (6) development instructional strategy (7) develop and select instructional materials, (8) design and conduct the formative evaluation of the instruction, and (9) revise instruction. The phases defined in the instructional systems approach are analysis, design, development, implementation, and evaluation of instruction (Dick et al., 2001). Dick and Carey also suggest that although summative evaluation is not a part of the design process, it is the culminating evaluation of the effectiveness of the instruction and is important (Dick et al., 2001).

Richey defines instructional design as "the science of creating detailed specifications for the development, evaluation, and maintenance of situations which facilitate the learning of both large and small units of subject matter (1986)".

A model of instructional systems design that is mysterious in origins, but commonly referred to in the instructional design space, is the ADDIE model. The acronym captures the stages in this design model which are; Analysis, Design, Development, Implementation, and Evaluation (Molena, 2015). It has evolved and been adapted over time, but the general premise of each stage are as follows. The analysis stage focuses primarily and performing an analysis of the learners, the context, the content, and the stakeholders. The design stage is the planning phase where the instruction starts to take form to meet the goals of the analysis. The development stage is the actual building or developing of the instructional materials. Implementation is the

delivery of the instruction to the learners, and the evaluation stage represents the summative evaluation of how the previous stages went and how the instruction was received by the audience it was intended for. Although the original source of the ADDIE model is elusive, it is used as a general "umbrella term" to refer to instructional systems design (Molena, 2015).

Instructional Systems Design for Behavior Change. Moisey states that, "adhering to traditional instructional systems design approach may not be sufficient to develop instruction that fosters learning and lasting behavior change, particularly in situations in which learners are resistant to change or where new behaviors must be integrated into their day-to-day life (2001, p. 61)". Moisey agrees that careful adherence to the ISD framework is important to develop the substructure of behavioral change, it may not be sufficient enough to effect behavior change, especially lasting behavior change (2001). Moisey proposes an integrated instructional design approach that utilizes instructional systems design with Social Learning Theory and the Stages of Change Framework, which can be very beneficial in situations where behavior change must be integrated into the learner's lifestyle or where resistance to change may be encountered (2001). A goal of creating the Brainbook concussion awareness education module was to not only provide information about concussions, the dangers of sustaining this type of injury, and the implications of concussions, but to also effect a shift in attitudes and subsequently behaviors of people in the target audience. Of interest in the research of this effort is the model followed by the instructional design team to accomplish the educational goals of the module.

Instructional Design Strategies for Health Behavior Change. In a comparative literature review conducted by Kinzie (2004), several widely adopted models and theories regarding designing instruction for health behavior change were analyzed to see if application of the theory or model yields the behavioral outcomes that educators hoped for. The three of particular interest in this study were the Health Belief Model, Social Cognitive Theory, and Diffusion Theory (Kinzie, 2004). Although these models and their desired outcomes were analyzed in relation to adolescent smoking cessation education, their results and strategies are still comparable to other interventions related to adolescent behaviors. The strategies applied in the studies to elicit health behavior change were analyzed and defined (Kinzie, 2004). No one strategy was used in all of the studies analyzed (Kinzie, 2004). The strategies employed in eight of the nine studies involved conveying threats to health, making desired behaviors easy-to-understand and do, and providing authentic practice and feedback (Kinzie, 2004). The strategies employed in seven of the nine studies were utilizing peer models to help guide and influence behavior (Kinzie, 2004). And five of the nine studies analyzed emphasized tailoring the message to fit the audience's prior knowledge and values (Kinzie, 2004).

All of the above mentioned topics and strategies have been considered to varying degrees in the design and development of this unique educational module. This unique combination of factors makes this a very valuable and appropriate module on which to conduct design and development research.

Design and Development Research

Design and development research is defined by Richey and Klein (2007, p. 1) as, "the systematic study of design, development and evaluation processes with the aim of establishing an empirical basis for the creation of instructional and non instructional products and tools and new or enhanced models that govern their development." Design and development research takes the two worlds of research and practice and creates knowledge from them. The goal in doing this type of research is to create an empirical basis for the practice of instructional design. As Richey and Klein establish, "the need for research on the models and tools that designers and developers use in instructional design is necessary to our developing of scientifically based understanding of these processes" (2007, p.3).

Design-based Research. Wang and Hannafin (2006) identify five basic characteristics of design-based research as being (1) pragmatic, (2) grounded, (3) interactive, iterative, and flexible, (4) integrative, and (5) contextual. To be considered pragmatic, design-based research needs to prove the extent to which the principles and concepts of the theory both inform and improve the practice (Wang & Hannafin, 2006). To qualify as grounded, the research must be both (1) theory-driven and grounded in relevant research, theory and practice, and (2) conducted in a real-world setting where the design process is embedded in and studied through design-based research (Wang & Hannafin, 2006). For the research to be interactive, iterative, and flexible, designers must be actively involved in the design processes working together with participants, and these processes must follow an iterative schedule of analysis, design, development, implementation, and redesign. To be deemed integrative, the research must employ

mixed methods that can vary at different phases to accommodate new needs and issues as they emerge. And finally, design-based research must be contextual, meaning that the process, findings, and changes from the original plan are documented, and the results of the research are connected to the design process and setting (Wang & Hannafin, 2006).

Reeves (2000) believes that educational technology research needs a "socially responsible approach" and that approach should take the shape of research that is labeled "design-based research" (Kelly, 2003), "development research" (van den Akker, 1999), or "formative research" (Newman, 1990). The characteristics that are considered critical by Brown (1992) and Collins (1992) are addressing complex problems in real contexts in collaboration with practitioners, integrating known and hypothetical design principles with technological advances to render plausible solutions to these complex problems, and conducting rigorous and reflective inquiry to test and refine innovative learning environments as well as to define new design principles.

Stark differences exist between the philosophical framework and the goals of traditional educational technology research methods, and design-based research approaches (Reeves, 2000). Van den Akker makes clear those differences:

> More than most other research approaches, development research aims at making both practical and scientific contributions. In the search for innovative "solutions" for educational problems, interaction with practitioners … is essential. The ultimate aim is not to test whether theory, when applied to practice, is a good predictor of events. The interrelation between theory and practice is more complex and dynamic: is it possible to create a practical and effective intervention for an existing problem or intended change in the real world? The innovative

> challenge is usually quite substantial, otherwise the research would not be initiated at all. Interaction with practitioners is needed to gradually clarify both the problem at stake and the characteristics of its potential solution. An iterative process of "successive approximation" or "evolutionary prototyping" of the "ideal" intervention is desirable. Direct application of the theory is not sufficient to solve those complicated problems (van den Akker, 1999, 8-9).

Reeves (2000) believes that van den Akker's (1999) conception of design/development research is a feasible approach for conducting socially responsible research. Design/development research is an important consideration when designing for and creating new instructional materials.

Reeves describes the four steps to design and development research in the form of inquiry as (1) analysis of a practical problem by researchers and practitioners, (2) development of solutions with a theoretical background, (3) evaluation and testing of solutions in practice, and (4) documentation and reflection to produce design-development guidelines (2000, p. 25). The goal here being again to create guidelines and theories by which practitioners can operate that is grounded in research in practice.

Development Research. Van den Akker lists the following characteristics of development research:

(1) A focus on broad-based, complex problems critical to education, (2) the integration of known and hypothetical design principles with technological affordances to render plausible solutions to these complex problems, (3) Rigorous and reflective inquiry to reveal new design principles, (4) long-term engagement involving continual refinement of protocol and questions, (5) intensive collaboration among researchers and

practitioners, (6) and a commitment to theory construction and explanation while solving real-world problems (1999).

Development studies integrate state-of-the-art knowledge from prior research of design processes and fine-tuned educational innovations based on piloting in the field (Nieveen, McKenney, & Van den Akker, 2006). Throughout the process of the development study, implicit and explicit design decisions are recorded. By documenting this design process in this way design principles can be identified that can inform future development and implementation studies (Nieveen et al., 2006). Two main types of principles are addressed, (1) procedural design principles and (2) substantive design principles (Nieveeen et al., 2006). Procedural design principles refer to the design approach and substantive design principles refer to the characteristics of the design itself (Nieveen et al., 2006). These guidelines help others to select and apply the most appropriate information for accomplishing a design task and so an accurate and detailed portrayal of the context is essential (Nieveen et al., 2006). In this dissertation study both procedural and substantive design principles were recorded and analyzed to form recommendations and best practices for others in the field looking to design online educational experiences that have unique characteristics similar to this one.

Study Purpose and Questions

This research study combined the rising need to educate those in sport about concussions and their implications and the delivery mode most suited to teach this content to a high volume of student-athletes. The purpose of this study was to investigate the analysis, design, development, implementation, and evaluation of a web-based program for knowledge acquisition along with attitude and behavior change for high school athletes at risk for concussion. The following questions were addressed in this study:

1. What decisions are made at each stage of the ADDIE model when designing instruction for attitude and behavior change for a high school athlete population?
2. What are the challenges and decisions associated with designing instruction in an environment that resembles popular social networking sites?
3. What guidelines/best practices emerge from the process of designing instruction with elements and functionality of a social network as a result of this study?
4. Do the learners find the program, usable, motivating, and does it impact their attitude?

CHAPTER 2

METHOD

Design and Participants

This study examined the analysis, design, development, implementation and evaluation phases of the creation of a concussion awareness online computer-based instructional unit from inception to completion. The study followed the tenets of design and development research (Richey & Klein, 2007). It employed multiple research measures to gain a rich and comprehensive data set from which to make interpretations and recommendations. Qualitative data measures included the documented design process, designer impressions, client impressions, learner impressions and learner perceptions. Quantitative data was collected on the learning measures in the form of pre and posttests and on learner attitudes in the form of questionnaires.

Participants in this study were four doctoral students at a large southwest university who formed an instructional design team of their own volition separate from their course of study. The members of the team varied in both their specialized skill sets and their experience working on instructional design projects. The researcher in this study was also an instructional designer. Other participants included the client for whom the instructional design work was contracted and a sample of approximately 80,000 student-athletes representative of the population the instruction was created for.

The setting in which this research took place included the workspaces of the instructional design team, the meeting places with the client, and the classrooms where the instructional unit was delivered.

Data Sources

In this study, data were collected from three main categories, as defined by Richey and Klein (2007). These three main areas are profile data, in-progress project data, and try-out data. Sub-sources exist in each of these categories and are outlined below in greater detail. In collecting data, triangulation was achieved by findings from the designers, client, and the try-out group of learners.

Profile data. Profile data of both the participants and the ID project was collected. Participants in this project included the designers/developers, the design team, the client, and the learners. From the designers/developers, information regarding demographics, education, level of expertise, years of experience, and information about their current job and duties was collected. Data collected about the design team included the size of the team and the make-up of the team. From the client, information about their years of work experience and educational background was collected. From the learners, data on age, year in school, primary language, sports participating in, and gender was collected.

Profile data of the ID project was also collected. This includes information about the scope of the project, resources, and the characteristics of the product. For the scope of the project data, the number of personnel, number of targeted learners, cost, and allocated work time was collected. For the resources set of data, information about the design facilities, design equipment available, delivery equipment available, and quality of the available equipment was collected and reported. Finally, data about the product characteristics was collected including product type, delivery, instructional content, time-on-task, and intended use.

In-progress project data. Richey and Klein (2007) believe that in-progress project data is a critical component in understanding design and development research. In this particular case, in-progress project data was analyzed retrospectively. The design team was asked what documents they created and maintained at various stages of the ADDIE model application. Items such as any logs of time and/or task completion, design documents, items provided to the client, and any other documentation of performance or problems encountered along the way. The interview protocol in Appendix A was conducted with the design team to gain further insight into these areas. The client in this project was also asked about their decisions made, tasks completed, information provided, opinions of the project, process, and satisfaction with the final product.

Try-out data. The final data source that was collected was the try-out data. These data were collected from the learners, designers/developers, and the client to help measure the success or failure of the product. Try-out data from the learners included a post-module attitude survey, a post-module design survey, and achievement scores on a posttest. These items are defined in Appendices B, C, and D respectively. The post-module design survey was created by the team to present situations that the student-athletes might face in an effort to measure their attitude towards concussions as a pre-cursor to behavior change. The post-module design survey was created to ask specific questions about certain design elements in the course. The designers/developers and client were also asked about their attitudes towards the finished product after implementation. Of specific interest in each of these groups is the attitudes surrounding the design of the module to emulate a popular social networking site.

Procedures

The development of the product on which this research is focused upon commenced in December 2010. The researcher in this study served as an instructional designer on the project. Throughout the process the design team kept certain documentation of the process, time spent, and other documents typically created and referenced during a design and development project. All of these documents and records were kept and created as either a requirement by the project manager or as a deliverable to the client. Upon completion of the design project the researcher went back and retrospectively analyzed these documents to look for themes, challenges, triumphs, and other telling details of the process. After retrospective data were analyzed, an interview protocol, included in Appendix A, was used to survey and interview the members of the instructional design team and the client.

After the module was developed, beta testing was conducted with approximately 25 high school athletes from high schools in the Southwestern United States along with several subject matter experts as identified by the client. The student athletes were required to take the module as a condition to participate in their sport, however participation in this study was voluntary following parental consent, and child assent. This occurred during the summer and fall of 2011 and data was collected as a pilot study research. The student athletes first completed a knowledge test to assess their current knowledge about concussions before beginning the module (Appendix D) (developed for AIA purposes and not part of the present study). They then entered the instructional module. In the module they received instruction that is based on the following objectives:

1. Recognize what a concussion is and the potential consequences of this injury.
2. Recognize concussion signs and symptoms and understand how to respond.
3. Determine appropriate prevention, preparedness and injury responses to help keep yourself and your teammates safe.
4. Identify appropriately balanced performance and safety attitudes.

After receiving the instruction participants completed a post-module design survey (Appendix C), and a knowledge test (Appendix D). The survey was aimed at gauging learner interest in the module, attitudes towards it, usability issues, items related to the design, and two open-ended questions to allow for additional feedback related to the design of the unit.

Once beta testing was completed, any modifications or changes to the module were made based on learner feedback, client feedback, and designer/developer feedback. The final product was then delivered to the client.

During Fall 2011, the module was delivered to approximately 80,250 student athletes in the state of Arizona. A portion of these data were collected and analyzed after the proposal was approved. Completion of the module was again required as a condition to play in their sport, but participation in the research was voluntary after parental consent and child assent. They were administered the same assessments as the previous group.

Data Analysis

There were several phases of data analysis in this research. Triangulation of the data was achieved through the various resources from which it was gathered to get a

whole picture of the design and development process. Each of the sets of data from the sources below were collected and analyzed to inform this study.

Designer Logs. All materials created and altered during the analysis, design, development, implementation, and evaluation phases of this project were reviewed and analyzed. Any challenges, triumphs, processes altered and/or developed, and other unique characteristics of the design process were looked for and noted. The designer log was created by the project manager as a tool to track project progress.

Designer Interview. After the designer logs were reviewed and analyzed a designer interview was conducted to further expand upon issues that arose during the process. The interview questions were developed by the researcher and were focused on asking designers about what they thought were the most successful parts of the project, what presented the most challenges, along with their overall satisfaction of the end product.

Client Survey. The client was also asked in interview form about what their impressions of the project were including satisfaction with the final deliverable, challenges they experienced, triumphs, design specifics and appeal, along with their impressions of how the team worked to create the final product.

Demographics. Demographics of the design team, client, and student-athlete participants were analyzed as part of portraying the context in which this research took place. The demographics of the student-athlete participant population have been generalized with descriptive statistics. These data were collected in post-module surveys that were designed by the instructional design team.

Test Scores. The scores from the pre- and post- tests were collected by the AIA, but were not accessible for this study.

Participant Post-Module Surveys. The post module participant surveys were used to determine the weaknesses and strengths of the concussion awareness module from the student perspective. Data is reported descriptively for all those questions using the Likert-type rating scale. The questions on these surveys were developed by the design team and researcher specifically to draw on the project goals and unique design of Brainbook.

CHAPTER 3

RESULTS

Design

The design and development of this online educational module followed the tenets of design and development research as determined by Richey and Klein (2007). The design team was made up of four graduate students in the Educational Technology Ph.D. program at Arizona State University in addition to a subject matter expert. The goal of the web-based module development was to provide educational materials on the topic of concussion to high school student-athletes in the state of Arizona in an online format. The overarching objective of the module was that the participants would be able to recall basic knowledge related to, signs and symptoms of concussion, and positively impact their view of concussions to ultimately reduce the instances of concussion injuries. The online module included the delivery of content that aligned with the instructional objectives, followed by a survey and knowledge test.

The participants in this module are represented in the data that follows.

Table 1

Participant Profile Data

Participants	Number
Doctor/SME	1
Instructional Design Team	4
Beta-test group	25
Student-athletes	80,250

Designer demographics. The design and development of this online educational module was conducted by the researcher in collaboration with the project team, composed of three other Educational Technology Ph.D. students, all serving as instructional designers, at Arizona State University. Each member of the time took on a different role that aligned with their strengths to fulfill the needs of the project. The Project Manager/Instructional Designer holds a Master of Arts degree in Organizational Management and has worked in training and practiced instructional design for 10 years. The Lead Instructional Evaluator holds a Master of Science degree in Instructional Design and Technology and has 5 years of instructional design experience. The Programmer/Developer on the project holds a Master's degree in Instructional Design and Technology and has 4 years of experience in development and programming in addition to 3.5 years of instructional design experience. The Instructional Designer, who was also the researcher, holds a Master in Education degree with a concentration in Educational Computing and Technology along with 1 year of instructional design experience.

Client Demographics. Also involved in the module design was client, physician, and subject matter expert, Dr. Javier Cardenas, from the Barrow Neurological Institute, for whom the team assembled to answer the "Call for Proposal", initiating this development. In addition to fulfilling the previously described roles, Dr. Cardenas also reviewed and provided feedback on the module as various stages of development. Dr. Cardenas holds a medical degree in Neurology and practices medicine in the area of child neurology. He has over 10 years of experience as a physician.

Module Description. The Keep Your Head in the Game: Concussion Awareness Training for High School Athletes, or Brainbook, is a stand-alone e-learning module designed to provide relevance and engagement for student athlete participants using a social networking framework (Figure 1). The module is designed to run for fifty minutes and to be highly interactive using short video clips with associated comments as well as polling features to allow students to experience the content as they are learning. The instructional goals of the module are to increase high school athlete's understanding and personal application of the causes and effects of concussions, and to motivate a change in attitude and behavior related to the perception, recognition, and care of head injuries. Funding and support for the program came from the Barrow Neurological Institute at St. Joseph's Hospital and Medical Center, the Arizona Cardinals, and the Arizona Interscholastic Association. Since the release of the module, it has been state mandated that high school athletes take this module prior to participating in any state sanctioned sport. The instructional objectives of the module were:

1. Recognize what a concussion is and the potential consequences of this injury
2. Recognize concussion signs and symptoms and understand how to respond
3. Determine appropriate prevention, preparedness and injury responses to help keep yourself and your teammates safe
4. Identify appropriately balanced performance and safety attitudes

The 50-minute module consisted of a series of conversations among characters that resembled a social networking "feed". Upon entering the module participants completed a survey that aimed to assess their current knowledge and attitudes towards concussions.

The participants were then presented with introductory information about the module including navigation instructions and the instructional objectives. The content was then presented on the subsequent screens (Figure 1) in the form of a conversation between the characters. This conversation, which resembled a "feed," occurred between such characters as high school athletes with differing attitudes and views of concussion, doctors, and professional athletes. The content was made up of images, videos, animations, and text composed of the approved curriculum content as overseen by the subject matter expert (Figure 2). Participants had the ability to actively engage with the content by "liking" posts made by characters in the module. At the end of the module participants completed a posttest to assess their knowledge after being exposed to the content (Appendix D) and were presented a survey that aimed to collect information on how they felt about the design of the instructional module, the delivery style, their attitudes towards concussion, associations to any of the characters in the module, as well as several open-ended items where they had an opportunity to provide feedback on what they would improve in the module and what they liked most about it (Appendix C).

Designer Log. The members of the team logged time and activities in a Google spreadsheet to track the hours spent in the different phases of the module development. The project officially kicked off on January 26th, 2011. A total 0f 300 hours were allocated to the project with a budget of $15,000.

The log was divided into the following sections: Project Management, Instructional Design, Development, Formative Evaluation & Report, and Finalize/Deliver Completed Module. This information was captured to help inform the in-progress project data to detail the design and development of this module.

Thirty hours were allocated to the Project Management phase and approximately twelve hours of actual time were recorded in this category. Activities recorded in this category include: developed project proposal/plan, ongoing correspondence with client, process initial A/P paperwork, create/submit invoices, create meeting reminders/meeting summaries, Assist with meeting notes/summaries, and run team meetings. The two members of the team participating primarily in this category were the project manager and the lead instructional evaluator.

Seventy project hours were allocated to the Instructional Design phase of the project and approximately fifty nine hours were recorded with the following project activities identified: learner analysis, detailed design document creation, weekly meetings, assessment items, video spot summary, initial content development/storyboard ideas, feedback and discussion of layout and design of instruction, storyboard/content mock-up design, graphic design, shell development and evaluating and constructing the module shell in Survey Gizmo © and Articulate ©. All members of the team contributed nearly equal amounts of time in this phase of the project.

The Development phase of the project was allocated 52 hours and just over 24 hours were recorded in the tracking log. A note here is that a freelance developer was hired and the hours for that development were not recorded in the tracking log. The activities recorded in this category were: Entering in all the data and figuring out all the CSS and DIV and videos, working with Articulate to test how Web Objects will look and work for our module. The team members involved in this phase of the project were the Programmer/Developer, the Lead Instructional Evaluator/ID, and the freelance programmer/developer. Although the hours were not recorded specifically for the

freelance programmer/developer it was noted that video editing and programming were the activities for the freelance developer time allocation of twenty-five hours.

The Formative Evaluation and Report phase of the project had an allocation of forty-four hours and fifteen hours were recorded. The activities in this area included: draft the evaluation plan and finalize assessment questions and create participant survey. The two primary team members logging time in this phase of the project were the Project Manager and the Instructional Designer/Researcher.

The last category on the tracking log was Finalize/Deliver Completed Module. This category had one hundred and four hours allocated and eighty-one hours were recorded. The activities in this phase of the project were: revising all the video and text adjustments, re-encoding and editing video, fixing sound, planning and coordinating tasks with AIA and St. Joseph. The project team members participating in this phase were the Programmer/Developer and the Lead Instructional Evaluator/ID. It is also noted that fifteen hours were allocated in this area for Outsource Video/Web Programming, however, no hours were recorded in the column capturing hours worked.

Detailed Design Document. After the project terms were set and agreed to, a detailed design document for the module was created. This document was created to capture the scope of the project, present the results of the analysis phase of ADDIE, and to communicate these project details to the client (Appendix G). The sections of the document included: Overview, needs analysis, learner analysis, graphic treatment, module outline, issues log, and next steps.

The Overview section of the detailed design document included basic information about the project including the module title, module duration, module goals, performance

outcomes, target audience, prerequisite skills, the number of participants, delivery method, resources, and the contact information for the project team.

The next section of the document captured the results of the Needs Analysis. The needs analysis was based on a review of the dissertation titled, *An examination of the knowledge about and attitudes toward concussion in high school athletes, coaches, and athletic trainers*, by Rosenbaum (2007):

> This study investigated athletes' and non-athlete's knowledge and attitudes about concussion injuries and their implications and determined that overall the target population had relatively low awareness and knowledge about the concussions and related injuries and their potential severity and consequently they viewed these injuries as relatively unimportant. This could be due to several factors 1) youth and the enhanced ability of their bodies to heal, thus, any injuries that may have been sustained likely healed relatively quickly without any chronic effects; and/or 2) the well documented sense of invincibility (i.e., immunity from negative events) that adolescents often possess. The findings of the study suggests that an extensive educational intervention is necessary to disseminate information about concussion to athletes and to their support networks with the hope of reducing the prevalence of concussions, multiple concussions, and chronic and catastrophic concussion outcomes (Rosenbaum, 2007).

This needs analysis data has informed our course objectives and overall course design structure in that the course is focused on increasing awareness and shifting high school athlete attitudes about the seriousness of concussions and related injuries by providing engaging and informative, interactive learning. The goal of

> the course is that the athletes participating will be more aware and concerned with potential injuries in themselves and their teammates while maintaining a positive performance mentality and goal orientation. (Rosenbaum, 2007).

The needs analysis also included the audience profile, location and population size, demographic factors, learner aptitude regarding module content, learning environment, computer abilities, the tone and communication style of the module, the origin of the instruction, and the intended shelf life of the instructional module.

The Graphic Treatment section included information on the expected branding of the module including the availability of existing colors, fonts, logos, and stock images. This was influenced both by the desire to emulate the look and feel of popular social networking on the desire of the client. Information on the desired visual elements to be included in the module (photography, video, animation) was also communicated in this section of the detailed design document.

The Module Outline portion of the document was organized in table format to show the relationship between each of the proposed topics or sections of the module, the content that would be covered for each topic, and the method of how that content would be delivered including some sample content, interactive deliverables, and the proposed final module assessment.

The Issues Log section of the design document outlined potential issues that could affect the module development including the responsible parties to address the issue, the date it was identified, and the date that it would need to be resolved by to maintain timely development meeting expectations.

The final section of this document was Next Steps. This section identified the next steps of collecting any existing stock images, videos, and animations as well as the development of the storyboard to inform the development of the prototype.

After the finalization of the detailed design document by the project team, it was sent to the client/physician for feedback. Completing these documents and tracking the project are typical steps in the processes for designing instruction. This not only helps to assure agreement on the project terms between all parties involved, it also informs future projects. The client reviewed the document, provided a small amount of feedback requesting a few changes and the approved the detailed design document sending the project into the Design Phase, which included the creation of the module storyboard.

Team Member Interviews

After the completion of the project and successful transfer to the client, each member of the team and the client were interviewed via email. The interview questions (Appendix A) focused primarily on gathering the team's perceptions about the challenges incurred during the course of the project, if their expectations for the project were accurate, the success of the project, and advice for anyone taking on a project similar to this one in the future. The interviews were analyzed and coded for challenges and resolutions, project expectations, satisfaction, and recommendations.

Challenges and Resolutions. The first question of the designer interviews asked the team about what they perceived to be the biggest challenges during the each stage of the ADDIE model's application to the project. The two biggest challenges identified by nearly all of the team members occurred at the development and implementation stages

of the project. At the development stage the primary challenge revolved around the selection of the appropriate technology to deliver the module. Although each team member identified a slightly different perspective on this challenge, the common thread was the technology. The first part of this challenge was in choosing a technology tool to design an education model that emulated popular social networking by allowing for participant interaction similar to that they would experience in a social networking scenario. The second part of the challenge was ensuring that the chosen technology tool could be to be used and maintained by the skill sets possessed within the team. The resolution to the first part of this challenge was the adoption of Survey Gizmo ©, an online survey tool, as the module platform. This also resolved much of the second part of the challenge in addition to contracting out a small portion of the coding/development work to achieve optimal functionality.

Probably the biggest challenge of the project, in terms of time cost and heightened sensitivity related to "go live" dates, occurring in the implementation stage of the project. The survey platform did not connect smoothly with the host site for the purpose of student tracking. Several members of the team cited that the expected level of testing was not conducted on the host site causing this inefficiency. Both the project manager and the lead developer felt that this particular challenge cost around 40 hours of time.

Time Investment. The second question of the designer interview asked the team about how the actual time investment aligned with their expectations of the time that would be required for the module development. Both the project manager and lead developer thought the time invested was in alignment with their expectations with the "go live" technological challenges cited as the most disruptive to the expectations. The lead

evaluator/instructional designer had a different perspective and shared that the project far exceeded his expectations in relation to the time commitment. His original perception was that the project would last 2-3 months, however, with the scope change and unforeseen success, it quadrupled that with future iterations/developments planned as well.

Adaptations. The next question on the designer interviews asked the team to identify what unforeseen tasks they had to adapt for during the development of the module. The lead evaluator/instructional designer identified the need for video editing and variable programming of the final product. The lead developer also noted the Cascading Style Sheet (CSS) programming and hiring of others to assist with project tasks that we did not have internal expertise in. The project manager thought the "handshake" between Survey Gizmo © and the AIA website was the most unforeseen task and adaptation.

Satisfaction of Final Product. Team members where then asked about their level of satisfaction with the final product. The lead evaluator and project manager expressed high levels of satisfaction with the final module product while the lead developer noted satisfaction while expressing that there were still bugs he would have liked to address but "it got the job done". The project manager also mentioned the satisfaction on the client's behalf as part of the measure for her satisfaction. All team members also stated that they enjoyed working on this project and with this team.

Future Design and Development Projects. In response to the question asking the design team if they would approach future design and development projects in the

same way this one was approached, all the design team members said that they certainly would. The lead evaluator also noted the importance of selecting a team based on the skill-set required for the project and that this development would serve as a model for future developments for him. In this same area, the team was asked what suggestions they might have for anyone looking to take on a project similar to this one. The lead developer suggested not following this model unless the interested party was especially devoted to designing it to stage a social media platform and interaction. He went on to say that the team laid some great groundwork in the area, but that other teams looking to design this type of instruction should complete a careful analysis of how their target population uses social media. The project manager suggested that other teams looking to complete this type of development spend considerable time up front planning and to have a specific and well defined statement of work in place early in the process to identify project specifics. She also noted that budgeting more time for development and reducing the analysis phase would be a suggested adjustment.

Lessons Learned. The lead developer, lead evaluator, and project manager were all also asked to identify any lessons learned from this project. In each of their responses, team members mentioned the importance of selecting a good team with the skill-set range necessary for the project. The lead evaluator went on to mention that a more robust task tracking system would have been a benefit to manage the team and have a more holistic view of the project. The lead developer outlined several technical lessons learned ranging from browser issues to the need to hire out programming in an effort to focus more on the instructional design.

Client Survey

The client and subject matter expert for this project was also asked the same series of questions that the designers were (Appendix A).

Challenges and Resolutions. The client identified the biggest challenges of the project as occurring in the development and implementation phases of the project. He cited timing as a large contributing factor to the challenged in the development phase since he was largely responsible for coordinating the numerous parties outside of the design team. He specifically stated the difficulty surrounding capturing video footage of the professional and amateur athletes appearing in the Brainbook materials. The resolution for this particular challenge was likely in place before the challenge was met by championing the project with the participating agencies and getting their buy-in. The client specifically said that all those involved worked persistently to make their efforts come together to in a timely manner. The other primary challenge noted by the client came in the implementation phase when there were some unanticipated difficulties making some of the technologies work together for the module launch. A considerable amount of effort in a very condensed amount of time was the costly resolution to this challenge.

Time Investment. For time invested in the design and development of Brainbook, the client said that the time investment, although difficult to predict having not worked on a project like this previously, was more than he anticipated but that it was time well spent.

Adaptations. When asked to identify any unforeseen tasks that required adaptation during the development, he only noted that there were several items that were completed beyond their anticipated time frame, however, the deadline was made despite these occurrences.

Satisfaction with Final Product. The client reported being very satisfied with the final product because it achieved all the objectives that were set out. He also went on to say that the universally positive response from the partners on the project as well as the public were indicators of success to him.

Future Design and Development Projects. In response to the question about using this same approach for future projects the client said that they will likely use the same model, but that because of the nature of some of the tools used, he would be open to different approaches to education. A suggestion for success he provided was to allow for "significant creative license" for the developers citing that doing so allowed for a "product that was truly interactive and educationally ground."

Lessons Learned. The lesson learned from the client perspective was related to the number of partners involved in the project and the necessity to coordinate all parties. This was a difficult task at times but he believes it lead to more superior product with the involvement of these parties.

Participant Data

Data from participants were collected and analyzed at two different stages of the project. The initial collection was at the beta-test stage to refine the module before

official launch and the second data set was collected after the launch of the module to high school athletes in the state of Arizona.

Beta-test results. The beta-test of the module was conducted with 25 athletes and a number of other subject matter experts (SMEs). The 25 athletes were a representation of the population that the module was intended for and the SMEs were solicited by the client and were typically colleagues or other professional contacts in the field. The beta-test participants went through the module and completed the pre-post tests and surveys. Revisions to the module were made based on the feedback from the SMEs (including the client) and from the instructional designer that was present during the beta test. This included videos not loading in Internet Explorer ©, making the videos a mandatory step (it was discovered that participants could skip the videos without watching), and doing another round of review for copy edit types of errors. Survey results from both of these populations were also analyzed and no further revisions were made based on the survey feedback. The final module delivery occurred about 4 weeks after the beta-test and 9 months after inception of the project.

Project implementation Results. The participants who received the concussion awareness education in this study were approximately 80,250 high school student-athletes in the state of Arizona ranging in age from 13 to 19. They completed the module in the Fall 2011 semester via the AIA as a condition to participate in their sport. These data were collected and analyzed by the team and delivered to the client as a Formative Evaluation Report after the initial run of the program.

Participant Demographics. Of the 80,250 student-athletes who participated in the Brainbook online learning experience, 45,876 (57%) were found to be male, while

34,374 (43%) were female. The proportion of student-athletes by year in school (Table 2) and age (Table 3) are both found below.

Table 2

Distribution of student-athlete participants by year in school.

Year	Number of Participants
Freshman	26,682
Sophomore	21,041
Junior	17,604
Senior	14,923

Table 3

Distribution of student-athlete participants by age.

Age	Number of Participants
13	2,561
14	19,562
15	21,517
16	18,368
17	15,194
18	2,862
19	186

Participant Post-Module Attitude Survey. After completing the pre-test, educational module, and post-test (again, not included in this study; just for AIA), student-athletes also participated in a post-module attitude survey (Appendix B) aimed at capturing their attitudes towards concussion and sports. Participants were presented a series of statements and were asked to rate their level of agreement with the statement on a five-item Likert-type scale ranging from Strongly Agree to Strongly Disagree. The figures presenting the results of this survey can be found in Appendix E. Below is a table presenting a summary of the results for these questions and distributions.

Table 4

Summary of student responses on post-module attitude survey.

Question	SA	A	N	D	SD
A concussion can occur only if there is a direct hit to the head.	18%	33%	18%	21%	10%
I feel that concussions are less important than other injuries.	1%	2%	8%	40%	49%
I would continue playing a sport while also having a headache that resulted from a minor concussion.	1%	5%	13%	37%	44%
There is possible risk of death if a second concussion occurs before the first is healed.	24%	47%	23%	5%	1%
I would play through any adverse conditions I can endure in order for our team to win.	4%	10%	21%	36%	29%
I feel that it is important to be thoroughly evaluated by a medical personnel after an injury to ensure full recovery	63%	30%	5%	1%	1%
I aspire to college sports with the ultimate goal of being a professional athlete. I feel that most high school athletes will play professional sports in the future.	29%	26%	29%	11%	5%
I feel that most high school athletes will play professional sports in the future.	3%	11%	34%	35%	17%
I feel that getting a concussion is not a big deal and actually proves that I'm tough.	1%	1%	4%	33%	61%
I feel that coaches need to be extremely cautious when determining if an athlete should return to play after an injury.	49%	41%	8%	1%	1%
I feel that if a star athlete gets a concussion during a playoff game they should return to the game since it could be the last one of the season.	1%	3%	9%	38%	49%
I feel that if I may be experiencing a concussion I should tell the coach or athletic trainer about my symptoms immediately	48%	41%	8%	2%	1%

N = 80,250

Participant Post-Module Design Survey. An additional survey was administered to the population that completed the Brainbook module in the Fall of 2011

that focused specifically on design aspects of the module to contribute to this research. This survey (Appendix C) was focused specifically on the design of the module and the elements that were unique to the social networking layout. The basic demographic information reported was collected in this survey as well as self-reported perceived learning. Several of these questions asked participants about what element of the module participants felt they learned the most from, the character they felt they learned the most from, the character they were most like in their attitude towards concussion and the character they thought represented the best attitude towards concussions. Statements related to the design of the module were presented and the participants were asked to rate their level of agreement with the statement on a Likert-type scale with 5 options. The results of these questions are presented in Appendix F as well as in tables 3 and 4 below.

Table 5

Summary of student responses on post-module design survey.

Question	SA	A	N	D	SD
I feel like I learned something new I didn't know before about concussions.	54%	36%	7%	2%	1%
I understand what I should do if I think that myself or one of my teammates has experienced a concussion .	65%	31%	4%	0%	0%
I found the design (colors, font, organization) of the instruction appealing.	20%	36%	34%	6%	4%
I found the module easy to navigate.	37%	46%	14%	2%	1%
I thought it was fun to learn by viewing conversations and video posts made by others.	31%	40%	19%	6%	4%

N = 80,250

Table 6

Summary of student responses on post-module design survey.

Question	Dr.	HH	DD	PP	SS	PA
Which character do you feel you learned the most from?	71%	14%	5%	4%	3%	3%
Which peer athlete character in the module do you feel you are most like in your attitude towards concussion?	NA	55%	17%	15%	13%	NA
In your opinion which character do you think had the best attitude towards concussion?	NA	68%	7%	18%	7%	NA

N = 80,250

Design Decisions. This design and development project pursued the general process of the ADDIE model of instructional design where the following phases are worked through: Analysis, Design, Development, Implementation, and Evaluation. There were many discussions and decisions made throughout the project, however, the ones captured in Figure 3 are those that had the most impact at each stage and influenced the final product that was designed and developed.

In the analysis phase, which occurred over the span of approximately one month, the most significant decision was to use the Rosenbaum (2007) publication as a replacement for a more in-depth audience analysis. The Rosenbaum piece was also about behavior change in an audience nearly identical to the one in this project, high school aged student-athletes. This was decided out of a desire to execute the analysis quickly to get the project underway. Part of this decision also leaned on the fact that two members of the design and development team were former high school student athletes who maintained insights into that population.

In the design phase of the project, occurring over approximately two months, the most impactful decisions made were to design the module to look and feel like popular

social networking and the selection of Survey Gizmo © as the delivery platform. The decision to develop the module to emulate popular social networking programs was the most innovative decision in the project. This decision was made due to attempting to incorporate the notion of attitude and behavior change in a way that modeled current beliefs this population might have and show how those beliefs might be risky and that changing their beliefs was possible. Also considered was the familiarity of the look and feel of this type of information presentation from their experience using this type of social networking. The decision to use the Survey Gizmo © platform was based on the fact that it could meet the needs of the content display preferences (to emulate social networking) while also being low cost, required little training, and was largely within the skillset bandwidth of the development team.

In the development stage, spanning five months, the most impactful decision was the inclusion of 12 2-minute videos. This was an unexpected scope change, however, the team decided it would be well worth the extra effort since the client already had the videos, it was in clear alignment with project goals, they added to the media-rich experience, and the cost of time and money was relatively low.

At the implementation stage, lasting approximately one month, it was decided to conduct a beta-test of the developed module with a small sample of the student-athletes representing the population it was designed for and a subset of SMEs identified by the client. This beta-test effort helped to inform of minor edits and fixes that could be made before the full launch of the product.

CHAPTER 4

DISCUSSION

The purpose of this study was to examine the design and development of an educational module that delivered concussion awareness education content to high school aged student-athletes. The design and development of this online educational module, Brainbook, followed the tenets of design and development research as determined by Richey and Klein (2007), where the tasks of completing the design and development of the product were combined with studying the process. The study focused on what could be learned during the phases of design and development, identifying challenges that were encountered designing an education system that resembles social networking, testing the effectiveness of the module in relation to meeting the instructional objectives, and creating guidelines and best practices that contribute to the field of instructional design. This was accomplished through exploring research in the area of designing instruction for health behavior change amongst the teenaged population, studying the design process of the module developed, interviewing the design team and client, and analyzing the student-athlete results on the post-module attitude and design surveys. A critical component in the design of this instruction was an innovative decision to display the content in a different "conversational" way with the hopes that this would both appeal to the audience the module was intended for and would help the information and issues resonate more with the population. This chapter synthesizes the implications of designing, developing, and delivering this instructional module from the perspectives of the instructional design team, the client, and the student participants.

Design and Development Process.

The process of designing and developing the Brainbook module followed the general tenets of the ADDIE model and occurred over a timeline of approximately 9 months. Over this period of time the team met with the client on an as-needed basis and communicated internally and with the client primarily over email. Details of the process were captured and recorded primarily in the designer log (time and task tracking), the detailed design document, and storyboards. In some cases email chains were reviewed for timeline information and other details to better inform these areas. A literature review was also conducted to inform the team of best practices for approaching the design and development for this type of instruction. It is important to note that although this was a four-person effort over 9 months, it was in addition to other work and responsibilities for all members of the team. The final module was estimated to take a typical target student approximately one hour to complete.

Analysis. The analysis for the project was conducted in relatively short order due to time constraints and urgency to get the project started to meet the launch goal. The client provided the details of the intended audience, goals for the project, available resources, and overall vision. Two members of the team also had experience as high school athletes and so maintained insights into the culture and attitudes that can be present in this population. These insights were about the attitudes and culture of high school sports where what your teammates say and do is highly regarded and that there is a sense of "invincibility" with athletes who think that they won't get hurt playing sport and that if they do, they will heal quickly. These insights also informed the decision to have the content appear more like a conversation amongst athletes where a change in

attitude was modeled. The final piece of the analysis was based on a paper written by Rosenbaum (2007), which concluded that "an extensive educational intervention is necessary to disseminate information about concussion to athletes and to their support networks with the hope of reducing the prevalence of concussions, multiple concussions, and chronic and catastrophic concussion outcomes" (p. iv). This is because, as Rosenbaum (2007) found, that athletes and non-athletes in this target population possessed a low level of knowledge and awareness about concussions and the severity of injuries to the head. This was suspected to be because adolescents have a sense of invisibility, or immunity from negative events, and/or that they believe to have a enhanced sense of their ability to heal. Considering that the audience and goals of the project conducted by Rosenbaum were nearly identical to what was being pursued in this project, the team decided this was a sufficient replacement to a more deliberate and intensive audience analysis while still informing the content and design of the module to directly address these characteristics of the audience. However, for anyone looking to replicate this type of development, it would be advantageous to build in time for a deeper analysis into the audience designing for.

Design. After analysis, the project moved quickly into the next stage of the ADDIE model, the design phase. The detailed design document, designer log, and storyboards were the client deliverables in this phase.

Detailed design document. The first deliverable to the client in this project was the detailed design document (Appendix G) This document captured and conveyed details of the proposed development to the client. It proved to be an incredibly valuable communication tool for the client and the team as it was the basis for conversations

surrounding the development of the module. It included information about the literature review-based needs analysis, defined the scope of the project, examples of the branding and graphic treatments to be included in the module, the topic outline, an area to log issues, and information about the next steps. The detailed design document helped to bring together the vision of the project together conceptually so that all parties had a clear picture of the project and how it would appear as a finished product. After several iterations, the detailed design document was approved by the client, and the storyboards were then started. This document also underwent several revisions with feedback from the team and the client to ensure clear expectations, content alignment, and other details. This document was a valuable tool in setting expectations and scope for the project.

It should be noted, however, that the project did experience some "scope creep" as the project moved into development and though negotiations were made to include the expanded scope, it was beneficial to have this document as a representation of the original, agreed upon scope. Additional details of the magnitude of scope change along with the implications on the final product can be found in the development section following.

Designer log. The designer log was created and managed by the project manager as a way to track time and communicate task completion. The designated areas where time was to be categorized and tracked were Project Management, Instructional Design, Development, Formative Evaluation & Report, and Finalize/Deliver Completed Module. Three hundred hours were allocated to the project and a total of 191 were tracked in the time tracking document. It was estimated that the project would take approximately 300 hours to complete with the budget of $15,000. This worked out to a rate of approximately

$50 per hour for development. In reviewing this information and probing the project manager further, it was decided that more than 300 hours were likely ultimately put into the project, but were not recorded accurately or consistently. The tool used for tracking hours was a Google spreadsheet and so a tracking system that was more accessible or integrated into other systems being used for the project might have been a better tool for tracking the project time.

Storyboards. The storyboards were created to provide the client with a conceptual view of the look and feel of the module and to convey how the content would be delivered in a way that was representative of the social networking framework it was intended to model. This was delivered to the client to gather feedback and was approved approximately 4 months after inception of the project. The storyboards were done in PowerPoint and laid out the proposed structure and content of the module in a way that most closely resembled what the final product would look like. The agreed upon branding was represented in the storyboards as well. The approval of the storyboards marked the completion of the design phase formally (design adjustments were made ongoing during the project based on feedback and challenges related to technology functionality like limitations of Survey Gizmo © as the platform and skills of team members to carry out certain programming tasks) and the project moved into the development phase. A significant amount of communication and clarity around the project was established at this step. It is highly recommended to give the time and attention to creating a visual representation of the module for the instructional design team and client to come to consensus on. This ensures clarity around the look and feel of the project before significant resources are invested on the development.

Development. The development phase of the Brainbook project occurred over a span of 5 months with the first beta test occurring at approximately the 3-month mark. The development phase included a scope change that added 12 2-minute video clips at a cost of $2500 and 35 hours of additional work. After development began the client came to the team with the desire to add video content. The client had video clips from the institute's library that he was able to receive permission on to use in the module. These video clips were of students talking about concussions in a round table discussion format, or other physicians describing what happens during a concussion, as well as animations of what happens to the brain when it sustains a concussion injury. The team and the client both agreed that the content in these videos aligned with the goals of the project and would add significant value to the overall result. This phase also included a conversation with the Arizona Interscholastic Association, the responsible party for hosting the module and monitoring student progress, to discuss roles and responsibilities in executing that effort. The module was developed on Survey Gizmo © and required significant effort from the Programmer/Developer on the team.

The most notable implication with potential to impact future developments from this phase was the change in scope that added 12 2-minute videos to the module. This was easily agreed upon by both parties and turned out to be a huge benefit to the final product with over 50% of participants citing videos as what they learned the most from in the module.

Implementation. The implementation phase of Brainbook occurred over approximately 4 weeks time from the initial beta-test to the official course launch. After Brainbook was developed and tested, it was handed over to the Arizona Scholastic

Association to host and track progress. The handshake was not smooth as noted by both the programmer/developer and the project manager. This was because insufficient testing of the two platforms working in tandem had been conducted by the party that would host the final module. Despite agreeing to do so, the party that would host the module did not test how Survey Gizmo © would work with their database/tracking system that would be used to track completion and so the lead developer spent significant time here troubleshooting the issues until the two would work together to produce the intended result. It is recommended to ensure that proper testing of the hosting and tracking systems is in place far in advance of implementation to reduce the workload and stress of troubleshooting these systems days before a launch date.

Team Member Interviews

The instructional design team was made up of four Educational Technology doctoral students who self-assembled as a team and responded to the Request for Proposal for this project. Each of the team members were interviewed and each agreed that the collaboration amongst the team and the client went very well, and that the project was a success.

Challenges and Resolutions. The common theme around the challenges encountered in this development was technology. First, it proved challenging to select a delivery tool that would allow design of the module to look and operate like popular social networking. This was a critical design component and so was given high priority in the search for affordable tools that also maintained an ease of use to get up and running given the project deadline. Second, the technology also proved challenging during the

implementation phase as described in the previous section. It can be assumed that in projects like this relying heavily on technology for delivery of the educational content, there will be challenges. The key to mitigating those challenges is to dedicate enough time to researching technologies for those that best suit the project needs and doing ample testing with enough advanced time to conduct any necessary troubleshooting.

Time Investment. For most members of the team, the time investment required of this project was in alignment with their expectations. For another, it far exceeded, nearly quadrupling his predictions. It might have been advisable to have a conversation about these expectations at the start of a project to be sure everyone had similar expectations and could plan accordingly, although it did not seem to have a negative effect on the project overall. Each member of the team found the time invested worthwhile when compared to the success of the project.

Course Design Implications

Brainbook was designed to look and operate much like a popular social networking site. This was an innovative decision to display the content in a different "conversational" way with the hopes that this would both appeal to the audience the module was intended for and would help the information and issues resonate more with the population. The characters in the module were created to represent four different potential attitude sets towards concussions. The characters were high school athletes playing different sports. They represented the different attitudes, different levels of experience, and were intended to be representative of the high school student-athletes. Much of the course content was delivered through these four characters (one female and

three male) and their interactions amongst themselves and their interactions with the doctor or professional athlete characters. In order to progress through each piece of content participants had to interact by choosing "like", "dislike", or choose a pre-determined "comment" option from a list. Once they did that and subsequently aligned an attitude or belief about the content, the next piece of content was revealed. This made the experience a very active one and the hope was that when associating a feeling or belief to the statement, more time would be spent to read, interpret, and absorb the content presented. This goes back to the desire to create an educational module that motivated attitude and behavior change.

Behavior Change Delivered via the Internet. As established by Roberts and Foehr (2008) the internet promises to be especially suitable for health behavior change interventions for young adult and adolescent populations since they grew up with the internet and are likely more open to the possibilities it affords. In addition, as Bernhardt and Hubley (2001) state, the internet maintains promise to reach large amounts of people and is an appropriate modality to deliver health behavior change interventions aimed at prevention of physical chronic disease. Considering the goals of knowledge acquisition, attitude and behavior change paired with the scale this module was to be delivered on, the appropriate choice was made for the general plan of how the module would be designed and developed. In addition to comparing back to these guidelines, the stakeholders involved in the project were very satisfied with its design and delivery.

Content Design for Behavior Change. In the meta-analysis conducted by Crutzen, et al. (2011), which focused on strategies to facilitate health behavior change delivered via the internet, they found that nine of the interventions studied delivered

customized information for the audience to some extent as well as supported the participants through either professionals or peers. In the Brainbook module, content was customized to the student population (they had a choice of how to align their attitudes or beliefs as they progressed through the content) as well as delivered exclusively by professionals and peers. When participants were asked in the post-module design survey (Appendix F) about which character in the module they feel they learned the most from, 71 percent chose the doctor. At just 14 percent, the next character was the one with the healthiest views towards concussion, Healthy Hank. This recognizes and confirms the recommendations for strategies to deliver health behavior change interventions via the internet. It is recommended for others designing instructional materials that are planned to be delivered online, that they consider the importance of an audience analysis to identify the professionals and peers that will resonate with the population to help change their behaviors.

The incorporation of social learning theory was also a strong consideration during the design of the module's content. Social Learning Theory states that analysis and understanding of a learner's social context should be considered when creating instruction that will promote and sustain behavior change (Moisey, 2001). You must consider "normalizing" the experience so that learners understand that their current beliefs and behaviors are "normal" but also that possible changes can be made, identify potential barriers that may be present for performing the desired behavior, build on existing social supports, and to develop social skills in your learners (Moisey, 2011). Each of these recommendations were considered in the design and development of the Brainbook module. In the post-module design survey (Appendix C) students were asked

both which peer athlete they most identified with in their attitude towards concussion (Appendix F) and Daredevil Dan, the character that initially presented the worst attitude towards concussion was the second most popular choice made at 17 percent (following Healthy Hank at 55%). The module was constructed in such a way that Daredevil Dan experienced a change in his attitude towards concussion. It is also worth noting that when asked which character they learned the most from, participants third most popular choice was Daredevil Dan (following The doctor at 71 percent and Healthy Hank at 14 percent) at 5 percent. This is a hopeful sign that the population with the most high-risk behaviors towards concussion, were reached on some level. Although it's not possible to make any direct conclusions from this, it is does help make the case that the design of the module was effective in incorporating these recommendations from Moisey (2001) and potentially incurring behavior change in the student-athlete population it was designed for.

Content Delivery for Behavior Change. Crutzen et al. (2011) goes on to state that five of the interventions studied provided content in an interactive way, while four presented the content in an easily accessible linear design. In the post-module survey, 83% of participants (46% agreed and 37% strongly agreed) found the module easy to navigate. This evidence is very reassuring from the design perspective that the content was designed and delivered in a way that supports the mission of designing health behavior change to be delivered via the internet.

Further building on this, the meta-analysis by Crutzen et al. found that two of the interventions made use of progressive presentation of the content so that users course not move on until they viewed the previous component. Brainbook was designed in such a

way that participants had to "like", "dislike", or "comment" on each piece of the content "conversation" thereby interacting at each step of the content delivery and the progression through the content as well as aligning their attitudes to some degree with the attitudes of the characters in the game. This method was employed both for the attitude alignment consideration as well as to help ensure that participants read the material as they moved through the module. While it cannot be determined directly that attitudes were affected by the necessity to check "like", "dislike", or "comment", 71 percent of participants found it "fun to learn by viewing conversations and video posts made by others." This further confirms the design decisions made by the instructional design team to structure the module in the way they did.

Designing for Attitude Change. The design and development of Brainbook also hinged on the desire to change the attitudes of those with high-risk attitudes and subsequently potential high-risk behaviors towards concussion to align with a more healthy view where they put their health and well-being before winning in their sport. The post-module attitude survey (Appendix E) aimed to measure the attitudes towards concussions that the learners possessed after completing the module. Since there were not direct measures of behavior change in this study, these attitudes were captured and analyzed as potential pre-cursors to behavior change.

Attitude, concussion, competition, and self. When presented with the statement "I would continue playing a sport while also having a headache that resulted from the minor concussion," 81 percent of participants chose strongly disagree or disagree (44 and 37 percent respectively). Participants were also presented with "I would play through any adverse conditions I can to endure in order for our team to win". In this case 65

percent of participants disagreed or strongly disagreed with this attitude statement (36 and 29 percent respectively). Both of these findings are somewhat promising in the educational goal to ensure that student-athletes have appropriately balanced attitudes toward concussions when competing in their sport, however, it is clear that more can be done in the way of changing attitudes towards concussion. This might also be further explored to see if most student-athletes don't feel they'll ever be in position to make these decisions while playing their sport.

Attitude, concussion, competition, and teammates. One question on the survey asked participants their level of agreement with "I feel that if a star athlete gets a concussion during a playoff game, they should return to the game since it could the last of their season." Overall, 87 percent of participants strongly disagreed (49 percent) and disagreed (38 percent) with this statement. In comparing this finding with that of the previous section based on competition and self, it is interesting to note that when it came to a teammate, participants identified that they were more likely to recommend that the teammate sit out rather than play, versus when the situation was one they were present in as the competitor. A case for further exploration could also be made here.

Attitude, concussions, and medical attention. In responding to the survey 89 percent of participants strongly disagreed or disagreed (49 percent and 40 percent respectively) with the statement "I feel that concussions are less important than other injuries". In another statement participants were asked their level of agreement with "I feel it is important to be thoroughly evaluated by a medical personnel after an injury to ensure full recovery," 93 percent of participants strongly agreed or agreed (63 percent and 30 percent respectively). When it comes to the importance of seeking medical

attention for a possible concussion in themselves, participants aligned largely with the desired attitudes that the module aimed to reinforce regarding the severity of the injury and the importance to seek medical attention.

Attitude, concussions, and coaches/trainers. Two questions in the post-module attitude survey were focused on the coaches and/or athletic trainers as conduits to help when a concussion was a possible injury. The first statement "I feel that coaches need to be extremely cautious when determining if an athlete should return to play after an injury." Participants strongly agreed (49 percent) and agreed (41 percent) with this statement at a 90 percent overall rate. The second statement "I feel that if I may be experiencing a concussion I should tell the coach or athletic trainer about my symptoms immediately", yielded a strongly agree rate of 48 percent and an agree rate of 41 percent, totaling 89 percent of agreement. This suggests that student-athletes see their coach as the first path to receiving help if they think they have experienced a concussion and further consideration may be given to strengthening that connection both from the athlete and coach perspective.

Perceived Learning. Several of the post-module attitude survey questions were based on measuring knowledge acquisition after exposure to the module. The statement "A concussion can occur only if there is a direct hit to the head" yielded interesting and conflicting findings. The results showed that 33 percent agreed, 21 percent disagreed, 18 percent strongly agreed, 18 percent maintained neutral, and 10 percent strongly disagreed. This suggests that the content or future interventions might benefit from a deeper explanation of how a concussion might occur. Simultaneously, it is noted that simply aligning attitudes with a set of statements does not truly measure learning and also

does not account for nuances that may exist in the content and in the survey questions. Another statement "There is possible risk of death if a second concussion occurs before the first is healed", found that 47 percent of participants agreed, 24 percent strongly agreed, 23 percent were neutral, 5 percent disagreed, and 1 percent strongly disagreed. This is also promising in the respect of communicating the severity of the injury to the student-athlete population.

On the post-module design survey, participants were asked to identify their level of agreement with the statement "I feel like I learned something new that I didn't know before about concussions." In this case, 54 percent strongly agreed and 36 percent agreed, totaling an agreement rate of 90 percent. Although self-reported, this result is very rewarding for the team and stakeholders invested in this project indicating that the effort was a success with respect to learning about concussions.

Scope Change. After the project was decided upon and underway with an agreed upon scope of work, the desire to add 12 2-minute video clips was brought forth by the client. Consideration was given to this aspect based on the change in scope, additional cost, and project timeline and it was decided after an additional fee to the client, that these video clips would be added to the module. In the post-module design survey participants were asked "Which do you feel you learned the most from?." Fifty one percent of participants selected the videos with the doctor following at 24 percent, the posts and comments of the peer athletes coming in at 14 percent, and the professional athletes at 11 percent. This confirms that the video aspect really brought additional value to the project that was well received by the learners and therefore worth the additional cost and efforts.

Conclusions

This study set out to investigate the analysis, design, development, implementation, and evaluation of a web-based program for knowledge acquisition along with attitude and behavior change for high school athletes at risk for concussion. Overall, this study and project are considered a success with the stakeholder and project team satisfied with the module design and development, the confirmation from participants that learning occurred, and the survey data suggesting that appropriate attitudes towards concussion are most common among the student-athlete population it was delivered to. While the project wholly meets the terms of success it is also important to consider some of the strengths and weaknesses.

Strengths. The strengths of designing and developing Brainbook were the successful visual design to resemble popular social networking, the reach to a broad high school student athlete audience, the scope change to include video clips, the largely positive response from the client, project team, learners, and public, and the application of the team approach to instructional design.

The design of Brainbook to resemble popular social networking was the primary success of the project. This unique approach to delivering the content had positive effects on engagement with the module, learning, appeal of design, potential change in attitude towards concussion as a pre-cursor to behavior change, and satisfaction from the client.

In the Fall of 2011 launch of the module with the AIA, over 80,250 student-athletes participated and data about their participation were collected and analyzed. This number continued to rise after the conclusion of this study since completing the Brainbook concussion awareness education module became a condition for student-

athletes to participate in their sport. The delivery of the module on the internet was successful in reaching the large student-athlete population it was designed for.

The Brainbook module received positive recognition by the client, the project team, learners, and the public as evidenced by interview and survey results in addition to media coverage of the module. On the Barrow Neurological Institute website, it states:

> The response to Brainbook has been phenomenal. On the day it was released, Brainbook received over 260 instances of news coverage in 30 U.S. states and 10 countries. National coverage continues to this day, with inquiries from multiple states regarding implementation. Brainbook version 2.0 is in development, bringing rich media experience and portable device connectivity.

The project continuance to version 2.0 is also a strong indicator of success.

Lastly, another strength of the project was utilizing a team approach to instructional design to bring unique and varied perspectives to the project and ultimately how the idea to resemble social networking was born. Each member of the team took on a role that was well matched to their background and strengths and each recognized that working with the team was a positive and rewarding experience that impacted the success of the project.

Weaknesses. The weaknesses of this design and development project were the lack of consistent tracking system, the hand-off of the module from the team to the AIA for hosting, and the inability to reasonably measure whether behavior change was in fact affected after exposure to the module.

First, although the project team worked great together, took on respective roles that facilitated the process effectively, and created a successful educational module, they did not do the best job of tracking all aspects of the project. Although this did not impact the project, it does make replicating this type of work a little more difficult in the future as some details of the design and development process may now be lost. It is highly recommended for anyone looking to complete a study and development like this one to consider a project management or tracking tool that is easy to use and integrates with current systems to ensure that potentially important details are captured.

All members of the team and the client mentioned the technology hand-off of the module from the team to the AIA as a considerable disruption to the project. Insufficient testing was done by the hosting organization to ensure that all technology applications would "talk" and ensure a successful launch. Although this was sorted out in time for a successful Brainbook launch, it did cause a good amount of stress and cost time to project team members involved in that piece to sort out.

The final weakness of the project and study was the inability to reasonably measure if behavior change was a result of this educational intervention. Careful consideration was given to the design and development to include elements that facilitated this result, but it was not possible to truly measure if the behavior of the learners had changed. Instead, the post-module attitude survey was created to measure attitudes as a precursor to behavior change.

Implications

The creation and studying of the design and development of the Brainbook module has been considered a success and offers valuable insights into the project for those also looking to design and develop education related to behavior change delivered via the internet. Attention should be given to the design of the module to meet the recommendations for designing with health behavior change as a goal for this audience, utilizing the team approach to instructional design, details of the technology being employed to support the online delivery, tracking details of the project in a project management or other integrated system, and finding ways to more directly measure the desired behavior change as a result of the educational intervention.

Limitations.

Several limitations with this study and project must be mentioned. They include the limitations of the ISD framework to ensure a substructure for lasting behavior change, the potential for researcher/instructional designer bias, and the inconsistency in survey question construction.

Although Moisey points out that careful adherence to the ISD framework is important to develop the substructure of behavioral change, it may not be sufficient enough to effect behavior change, especially lasting behavior change (2001), this continued to be a project goal. Coupled with the fact that in this context is was not reasonable to measure behavior change, but rather analyze potential attitude indicators in a self-report survey, it is recommend that future studies are designed to more accurately and deliberately measure the impact on behavior change.

Also the researcher in this study was also a design team member and so bias may be introduced, despite the effort to triangulate the data to reduce this risk.

Another limitation is the inconsistency in questions for surveys. More consideration could be given to construct the survey questions in a way that lends to a more comparative analysis of the participant attitudes. For instance when comparing the self to teammates the survey questions were somewhat inconsistent in how they addressed the issue and thus made it more difficult to compare directly how the participants attitudes towards self or their teammates might differ.

Future Research

There are multiple areas where future research might be employed to explore a greater understanding of designing and developing educational interventions for health behavior change.

One possibility would be to study the module intervention with a smaller groups of participants over a longer period of time to measure if behavior change is a result. Another consideration here would be to simply ask the audience to self-report if they believe their behavior to have changed over time. It might even be suggested to have participants who respond that it has provide specific examples from their experiences.

Another suggestion for future research would be to administer the surveys to audiences that experienced two different content delivery modalities that are very different to explore if the impact of the design to resemble popular social networking truly has an effect on attitudes.

It might also prove valuable to modify the program or create an add-on approach to provide a longer-term intervention that could be researched on the basis of behavior change. This might include reaching out to participants at different times after they've completed the module to remind them of important messages from the course, or to have a structured coach communication procedure in place to leverage the pathway through the coach as being important to student-athletes to relay important reminders related to concussion awareness.

Also, as was mentioned on the Barrow Neurological Institute website, Brainbook version 2.0 is in development and it would be of interest to compare the two iterations of the program and similar concept.

A deeper investigation into the pre- and post-test and surveys would also be recommended as a way to better understand how much the intervention affected learners knowledge and attitudes and how much they were already aware of when they entered the Brainbook educational experience.

Summary

The findings of this study support the success of Brainbook in delivering education aimed at attitude and health behavior change for a large high school athlete population. The success of the project is marked by the client and instructional design team satisfaction with the final product, the perceived attitudes and learning of the student-athlete population, the continuation of the project into subsequent versions, and the success of the project as evidenced by the media. Despite some of the project and

study limitations and weaknesses, this study and the lessons it offers can be a valuable tool for anyone looking to replicate this type of educational module.

REFERENCES

Bandura, A. (1977). Social learning theory. Englewood Cliffs New Jersey: Prentice-Hall.

Barrow Neurological Institute. *About Brainbook* Article retrieved from: https://www.barrowneuro.org/get-to-know-barrow/centers-programs/concussion-brain-injury-center/barrow-brainbook-login/

Bernhardt, J.M., & Hubley, J. (2001). Health education and the internet: The beginning of a revolution. *Health Education Research*, 16, 643-645.

Brown, A.L. (1992). Design Experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of the Learning Sciences*, 2, 141-78.

Collins, A. (1992). Towards a design science of education. In Scanlon and T. O'Shea (Eds), *New Directions in Educational Technology* (pp.15-22). Berlin: Springer.

Crutzen, R., Nooijer, J., Brouwer, W., Oenema, A., Brug, J., & de Vries, N.K. (2011). Strategies to facilitate exposure to internet-delivered health behavior change interventions aimed at adolescents or young adults: A systematic review. *Health Education Behavior*, 38(1), 49-62. doi: 10.1177/1090198110372878

Crutzen, R., Nooijer, J., Brouwer, W., Oenema, A., Brug, J., & de Vries, N.K. (2009). A conceptual framework for understanding and improving adolescents' exposure to internet-delivered interventions. *Health Promotion International*. 24(3). 277-284. doi: 10.1093/heapro/dap018

Dick, W., Carey, L., Carey, J.O. (5th Ed.). (2001). The systematic design of instruction. United States: Addison-Wesley Educational Publishers Inc.

Field, M., Collins, M.W., Lovell, M.R. & Maroon, M. (2003). Does age play a role in recovery from sports-related concussion? A comparison of high school and collegiate athletes. *The Journal of Pediatrics,* 546-553.

Hannafin, M., & Wang, F. (2005) Design-based research and technology-enhanced learning environments. *Educational Technology Research and Development, 53(4),* 5-23. doi: 10.1007/BF02504682

Kelly A.E. (2003). Research as design. *Educational Researcher*, 32(1), 3-4.

Kelly, J.P. (1999). Traumatic brain injury and concussion in sports, *JAMA*, 282, 989-91.

Klein, J. D., & Richey, R. C. (2007) *Design and Development Research*. Mahwah, New Jersey: Lawrence Erbaulm Associates, Inc.

Molena, M. (2015) In Search of the Elusive ADDIE Model. *Performance Improvement, 54(2),* 40-42. doi: 10.1002/pfi.21461

National Center for Injury Prevention and Control. *Heads Up: Concussion in Youth Sports, Activity Report (2007–2008)*. Atlanta (GA): U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2008.

National Football League. *NFL Evolution: Safety Rules & Regulations (2013, August 9)* Article retrieved from: http://www.nfl.com/news/story/0ap1000000228345/article/safety-rules-regulations

Newman, D. (1990). Opportunities for Research on the organizational impact of school computers. *Educational Researcher,* 19(3), 8-13.

Nieveen N., McKenney S., & van den Akker J.(2006) Educational design research. In J. van den Akker, K. Gravemeijer, S. McKenney, & N. Nieveen (Eds.) *Educational Design Research* (pp. 151-157). New York: Routledge..

Powell, J.W. & Barber-Foss K.D. (1999). Traumatic brain injury in high school athletes, *JAMA*, 282, 958-63.

Reeves, T. (2000) Socially responsible educational technology research. *Educational Technology*, 19-28.

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). New York: Routledge..

Richey, R. (1986). *The theoretical and conceptual bases of instructional design*. Great Britain: Kogan Page Ltd.

Roberts, D. F. and Foehr, U.G. (2008) Trends in media use. *The Future of Children* 18(1) 11-37.

Rosenbaum, A. M. (2007). *An examination of the knowledge about and attitudes toward concussion in high school athletes, coaches, and athletic trainers (Docotoral dissertation).* Retrieved from ProQuest. (AAT 3299046).

van den Akker, J. (1999). Principles and methods of development research. In J. van den Akker, N. Nieveen, R.M. Branch, K.L. Gustafson, & T. Plomp, (Eds.), *Design methodology and developmental research in education and training* (pp. 1-14). The Netherlands: Kluwer Academic Publishers.

APPENDIX A

INTERVIEW PROTOCOL FOR DESIGNERS/DEVELOPERS AND CLIENT

1. What were the biggest challenges you faced during each stage of the ADDIE (analysis, design, develop, implementation, and evaluation) model's application to this project?
    a. What were your resolutions to those challenges?
    b. How much time do you think each challenges cost/lost you in addressing?

2. Did you find that time invested in the development of the project was what you anticipated? Why or why not?

3. What unforeseen tasks did you have to adapt for during the project development?

4. Are you satisfied with the final product? Please explain.

5. Will you approach future design and development projects in the same way that you did this one? Why or why not?

6. What suggestions for success would you give to someone taking on a project similar to this one?

7. What were your lessons learned during the execution of this project?

8. Did you enjoy working on the project? Why or why not?

APPENDIX B

PARTICIPANT POST-MODULE ATTITUDE SURVEY

All of the following statements are accompanied by a Likert-type rating scale with "Strongly Agree" to the far left, followed by "Agree", "Neutral" in the middle, "Disagree" second to the right, "Strongly Disagree" on the far right.

1. A concussion can occur only if there is a direct hit to the head.
2. I feel that concussions are less important than other injuries.
3. I would continue playing a sport while also having a headache that resulted from a minor concussion.
4. There is a possible risk of death if a second concussion occurs before the first is healed.
5. I would play through any adverse conditions I can endure in order for our team to win.
6. I feel that is important to be thoroughly evaluated by medical personnel after an injury to ensure full recovery.
7. I aspire to play college sports with the ultimate goal of being a professional athlete.
8. I feel that most high school athletes will play professional sports in the future.
9. I feel that getting a concussion is not a big deal and actually proves that I'm tough.
10. I feel that coaches need to be extremely cautious when determining if an athlete should return to play after an injury.
11. I feel that if a star athlete gets a concussion during a playoff game they should return to the game since it could be the last one of the season.

12. I feel that if I may be experiencing a concussion I should tell the coach or trainer about my symptoms immediately.

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APPENDIX C

PARTICIPANT POST-MODULE DESIGN SURVEY

1.) How old are you?
( ) 13

( ) 14

( ) 15

( ) 16

( ) 17

( ) 18

( ) 19+

2.) What year are you in school?
( ) Freshman

( ) Sophomore

( ) Junior

( ) Senior

3.) What is your gender?
( ) Male

( ) Female

4.) Is English your primary language?
( ) Yes

( ) No

5.) I feel like I learned something I didn't know before about concussions.
( ) Strongly Disagree

( ) Disagree

( ) Neutral

( ) Agree

( ) Strongly Agree

6.) I will take what I learned today and watch for it while playing my sport.
( ) Strongly Disagree

( ) Disagree

( ) Neutral

( ) Agree

( ) Strongly Agree

7.) I found the design (colors, font, and organization) of the instruction appealing.
( ) Strongly Disagree

( ) Disagree

( ) Neutral

( ) Agree

( ) Strongly Agree

8.) After completing this unit, I'll take head injuries more seriously.
( ) Strongly Disagree

( ) Disagree

( ) Neutral

( ) Agree

( ) Strongly Agree

9.) Which do you feel like you learned the most from?
( ) The posts and comments of the peer athletes

( ) The videos

( ) The doctor

( ) The professional athlete(s)

10.) Which character do you feel you learned the most from?
( ) The doctor

( ) The professional athlete

( ) Healthy Hank

( ) Cheerleader Christy

( ) Paranoid Pete

( ) Daredevil Dan

11.) I found the module easy to navigate.
( ) Strongly Disagree

( ) Disagree

( ) Neutral

( ) Agree

( ) Strongly Agree

12.) I found learning through viewing conversations and video posts made by others fun.
( ) Strongly Disagree

( ) Disagree

( ) Neutral

( ) Agree

( ) Strongly Agree

13.) Which peer athlete character in the module do you feel you are most like in your attitude towards concussion?
( ) Healthy Hank

( ) Cheerleader Christy

( ) Daredevil Dan

( ) Paranoid Pete

14.) In your opinion which character do you think had the best attitude towards concussion?
( ) Healthy Hank

( ) Cheerleader Christy

( ) Paranoid Pete

( ) Daredevil Dane

15.) If I could change one thing to improve my learning in this unit it would be...

16.) What did you like most about in this instructional module?

APPENDIX D

KNOWLEDGE TEST

1. Which of the following does not describe a concussion?

    a. Joint and muscle pain

    b. A serious brain injury usually caused by a blow to the head or body.

    c. A brain injury that can change the way your brain works.

    d. Potential long-lasting brain damage.

2. Which of the following most accurately presents the description of a concussion?

    a. A brain injury.

    b. Is often caused by a bump or blow to the head.

    c. Can be serious even if you've just been "dinged"

    d. All of the above.

3. When can a concussion occur?

    a. During a game but not during practice.

    b. Only if you are knocked out.

    c. Anytime a bump or blow to the head occurs.

    d. While playing a contact sport.

4. Finish the phrase with the best answer, "A concussion…"

    a..Is ONLY caused by a serious bump or blow to the head.

    b. Happens when you get knocked out.

    c. Can change the way your brain normally works.

    d. All of the above.

5. Which of the following is NOT a sign or symptom of a concussion?

    a. confusion

b. diarrhea

c. headache

d. dizziness

6. Which two of the following can be causes of a concussion?

a. Being knocked out

b. Spraining your ankle

c. Bumping your head

d. Tripping, but not actually falling down

7. What should you do if you think you have a concussion?

a. Shake it off if you feel fine after a blow or bump to the head

b. Tell your coaches and your parents

c. Get back in the game and worry about it later

d. Rest until you feel better able to return to play

8. What should you do if you think a teammate has a concussion?

a. Monitor them to see if symptoms get worse

b. Ask them if they are feeling ok

c. Tell your coaches/athletic trainer

d. Tell them to go to the doctor

9. What could happen if an athlete receives multiple concussions especially before an initial concussion is healed?

a. Severe brain damage

b. Death

c. Permanently impaired thought processes and motor control

d. Memory issues

e. All of the above

10. How can I prevent a concussion? (Select all that apply.)

a. Practice good sportsmanship at all times

b. Follow the rules for safety for the sport

c. A concussion is just one of the risks of being an athlete; not much anyone can do about it.

d. Use the right equipment for the game or activity

11. In which sports can concussions occur?

a. Basketball

b. Soccer

c. Football

d. Wrestling

e. All sports

12. When should you go back to play after a concussion?

a. whenever you feel ready

b. after two weeks

c. after one week

d. after ALL symptoms have resolved AND you have been cleared by a medical professional

13. How is the proper safety equipment best able to protect an athlete? (Choose all answers that are correct.)

a. The proper equipment is used when the athlete thinks there is potential for injury.

b. The proper equipment fits well

c. The proper equipment is worn every time you play

14. Which is the most important reason to be able to recognize the signs and symptoms and to choose to receive treatment for a concussion?

a. Your coach will be disappointed if you are unable to play in the future.

b. Your parents will be angry that you did not take good care of yourself.

c. You may not be able to play if you are injured.

d. Taking care of your health is up to you and can seriously impact your future brain and body health as well as your athletic participation.

15. Select yes or no next to each of the items below to indicate if it is a sign or symptom of a concussion.

	Yes	No
Difficulty Sleeping		
Bothered by light		
Bothered by noise		
Headache		
Coughing		
Confusion		
Feeling sluggish, hazy or groggy		
Dizziness		
Difficulty breathing		
Double or blurry vision		
Memory issues		
Difficulty paying attention		

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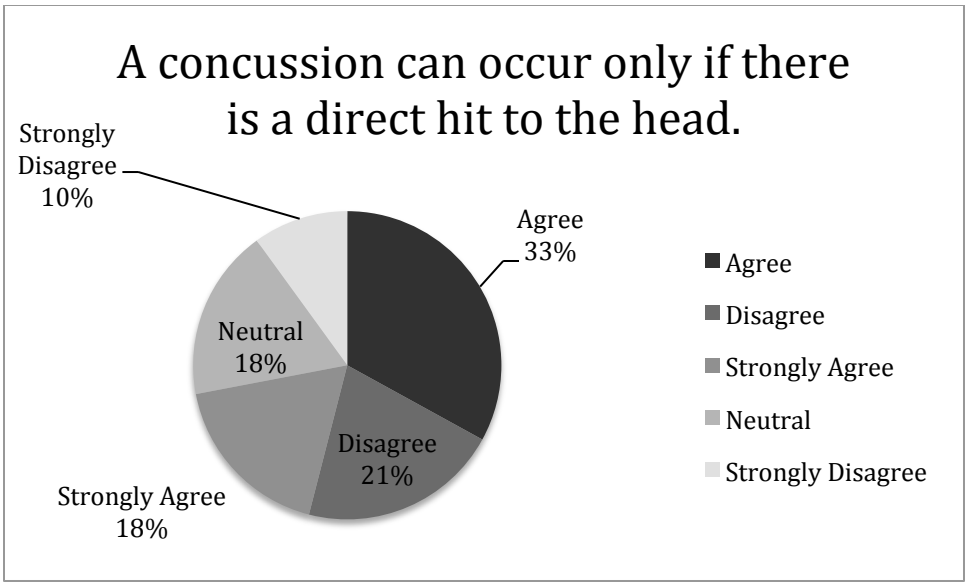
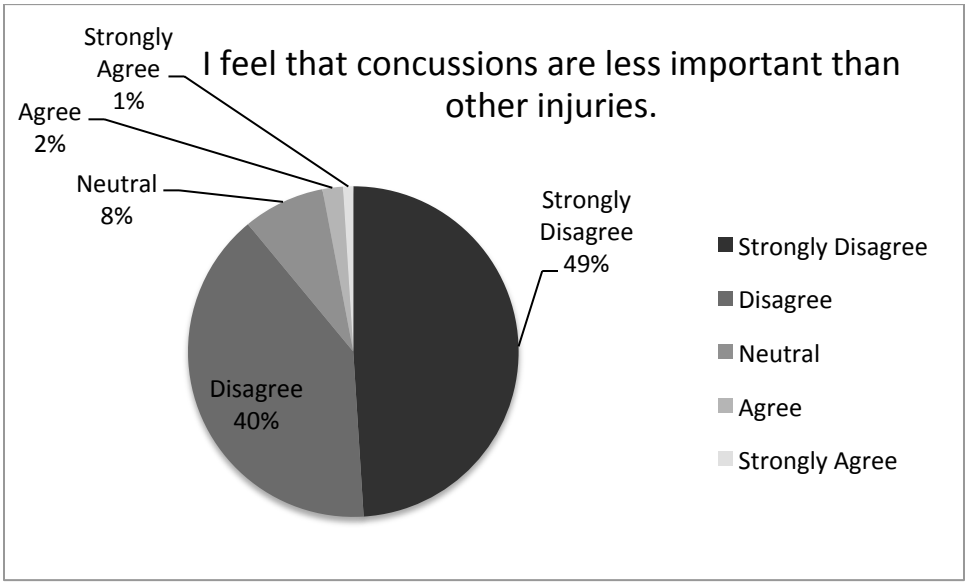
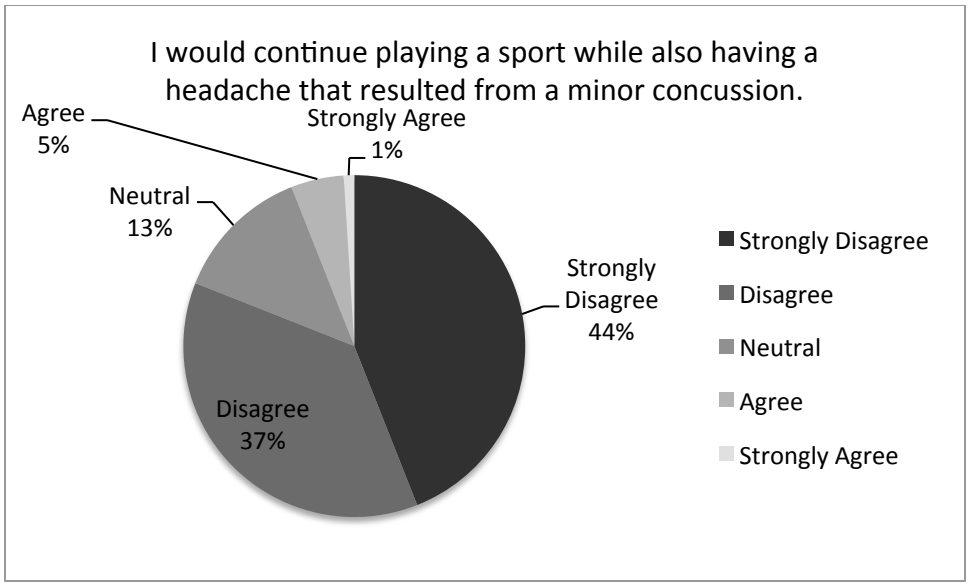
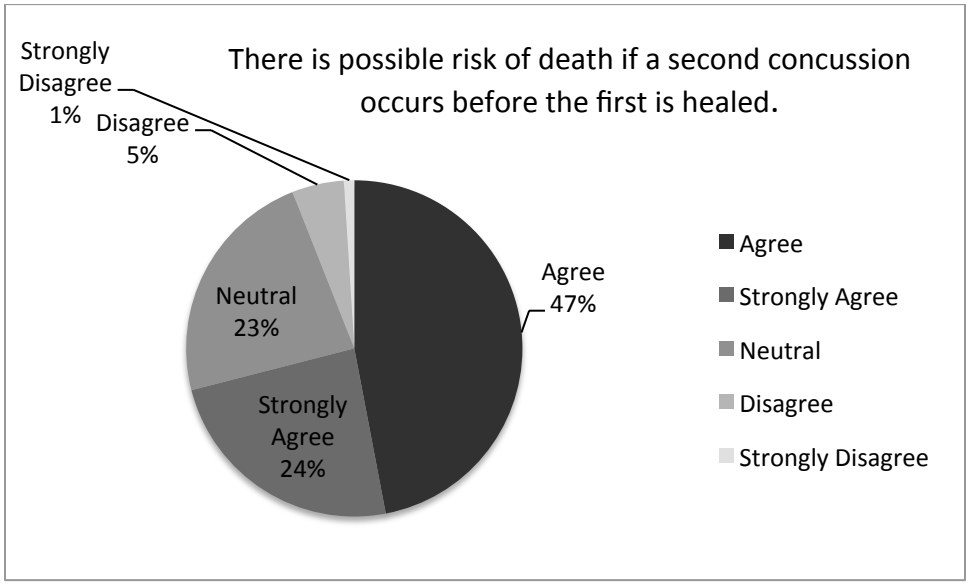
APPENDIX E

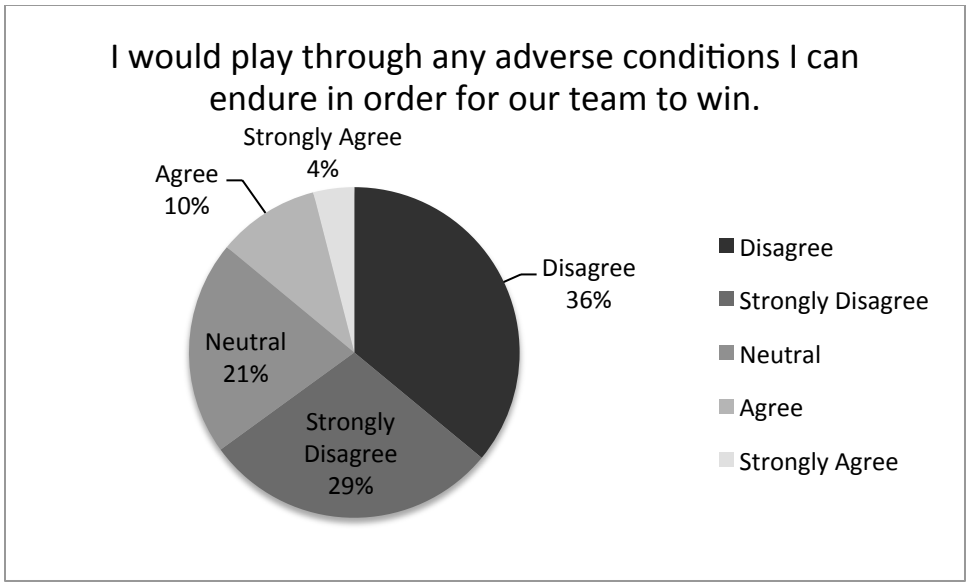
RESULTS OF PARTICIPANT POST-MODULE ATTITUDE SURVEY

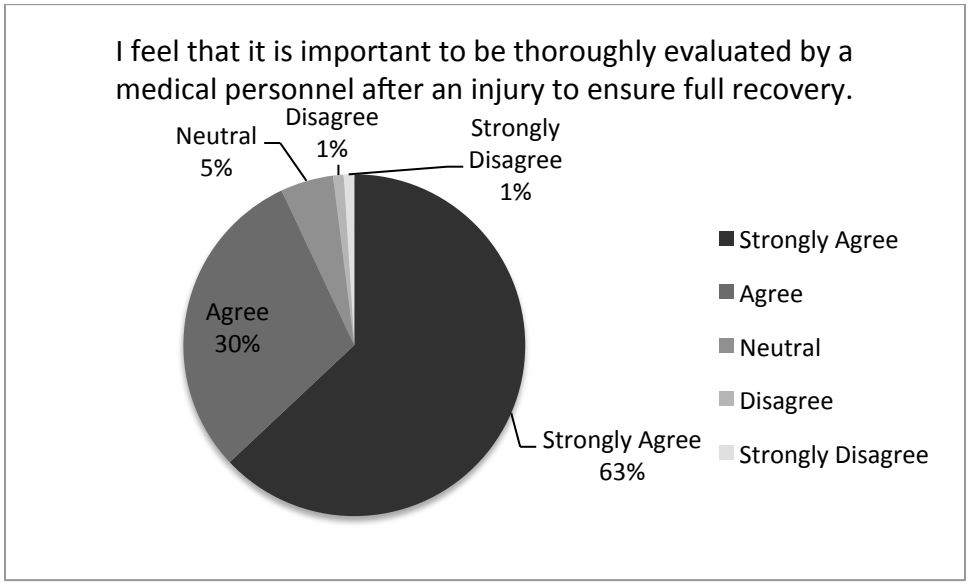

A concussion can occur only if there is a direct hit to the head.
Strongly Disagree 10%
Agree 33%
Neutral 18%
Disagree 21%
Strongly Agree 18%
Agree
Disagree
Strongly Agree
Neutral
Strongly Disagree

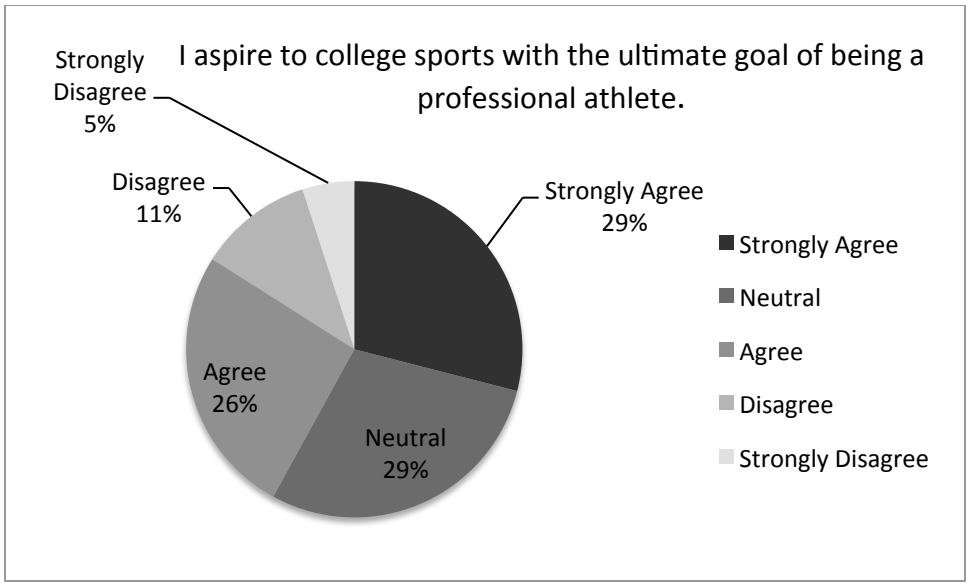

I feel that concussions are less important than other injuries.
Strongly Agree 1%
Agree 2%
Neutral 8%
Strongly Disagree 49%
Disagree 40%
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

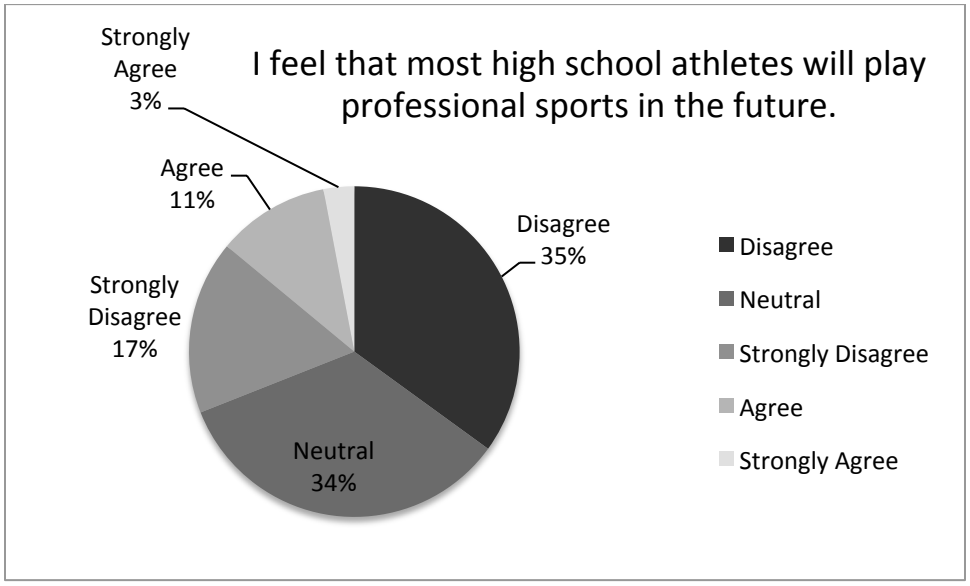

I would continue playing a sport while also having a headache that resulted from a minor concussion.
Agree 5%
Strongly Agree 1%
Neutral 13%
Strongly Disagree 44%
Disagree 37%
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

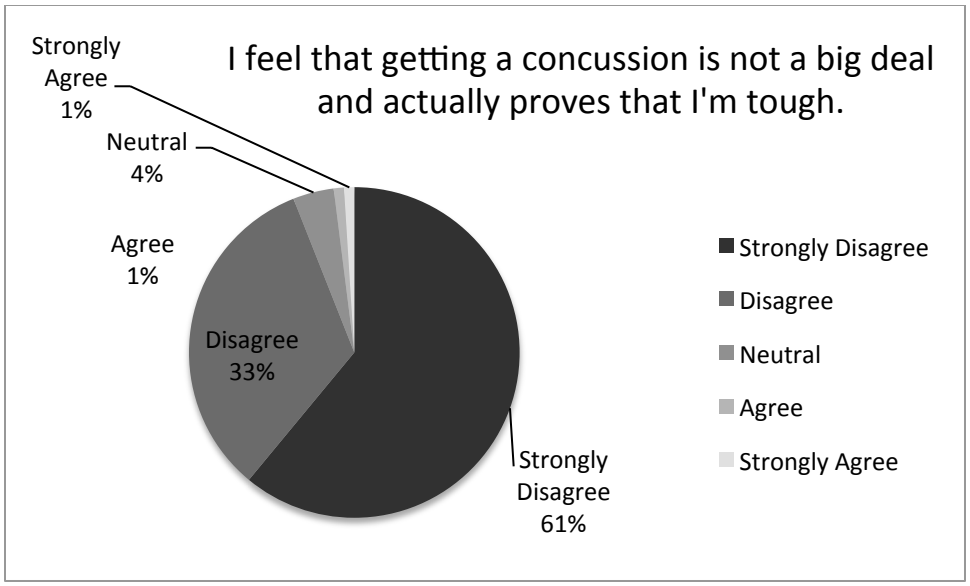

There is possible risk of death if a second concussion occurs before the first is healed.
Strongly Disagree 1%
Disagree 5%
Agree 47%
Neutral 23%
Strongly Agree 24%
Agree
Strongly Agree
Neutral
Disagree
Strongly Disagree

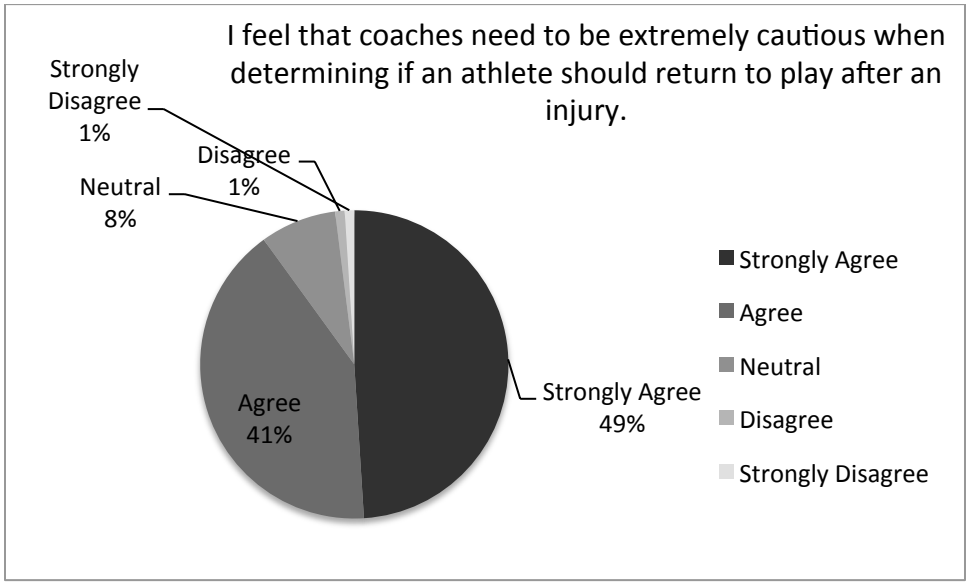

I would play through any adverse conditions I can endure in order for our team to win.
Strongly Agree 4%
Agree 10%
Disagree 36%
Neutral 21%
Strongly Disagree 29%
Disagree
Strongly Disagree
Neutral
Agree
Strongly Agree

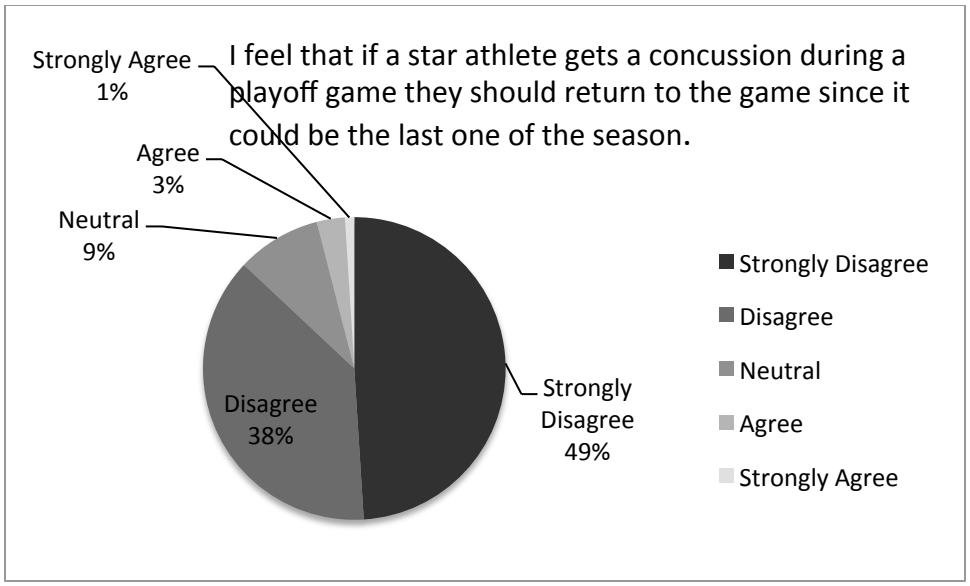

I feel that it is important to be thoroughly evaluated by a medical personnel after an injury to ensure full recovery.
Neutral 5%
Disagree 1%
Strongly Disagree 1%
Agree 30%
Strongly Agree 63%
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree

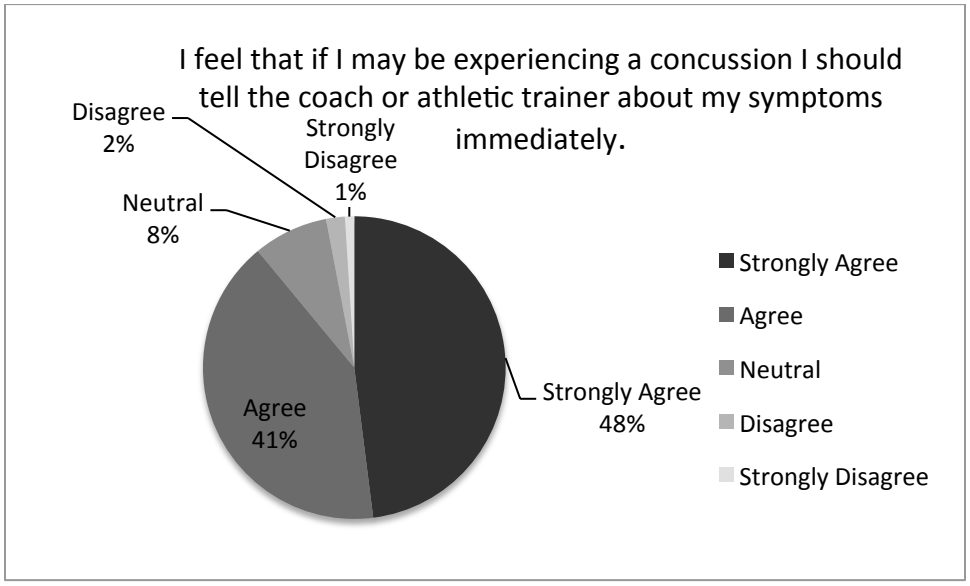

I aspire to college sports with the ultimate goal of being a professional athlete.
Strongly Disagree 5%
Disagree 11%
Strongly Agree 29%
Agree 26%
Neutral 29%
Strongly Agree
Neutral
Agree
Disagree
Strongly Disagree


I feel that most high school athletes will play professional sports in the future.
Strongly Agree 3%
Agree 11%
Disagree 35%
Strongly Disagree 17%
Neutral 34%
Disagree
Neutral
Strongly Disagree
Agree
Strongly Agree


I feel that getting a concussion is not a big deal and actually proves that I'm tough.
Strongly Agree 1%
Neutral 4%
Agree 1%
Disagree 33%
Strongly Disagree 61%
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

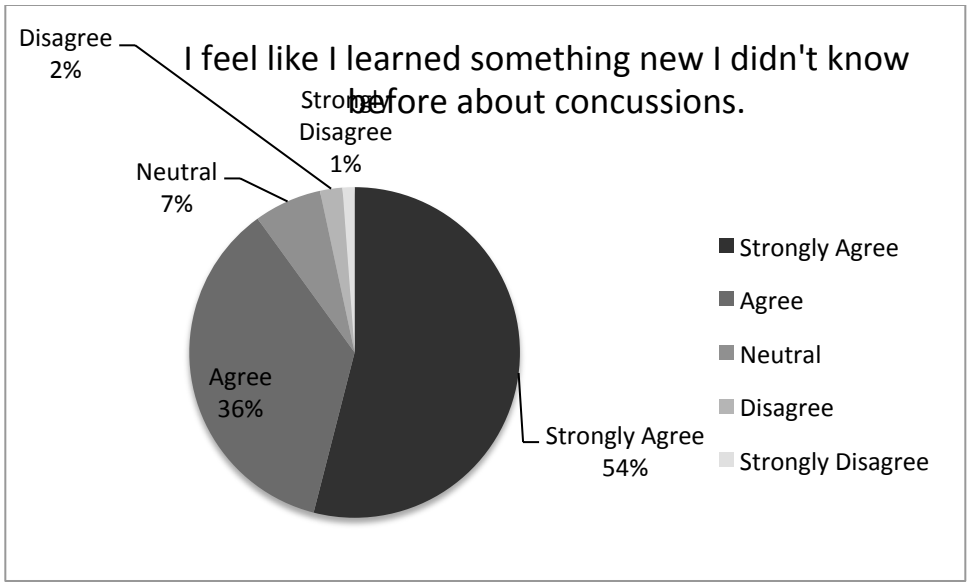

I feel that coaches need to be extremely cautious when determining if an athlete should return to play after an injury.
Strongly Disagree 1%
Disagree 1%
Neutral 8%
Agree 41%
Strongly Agree 49%
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree

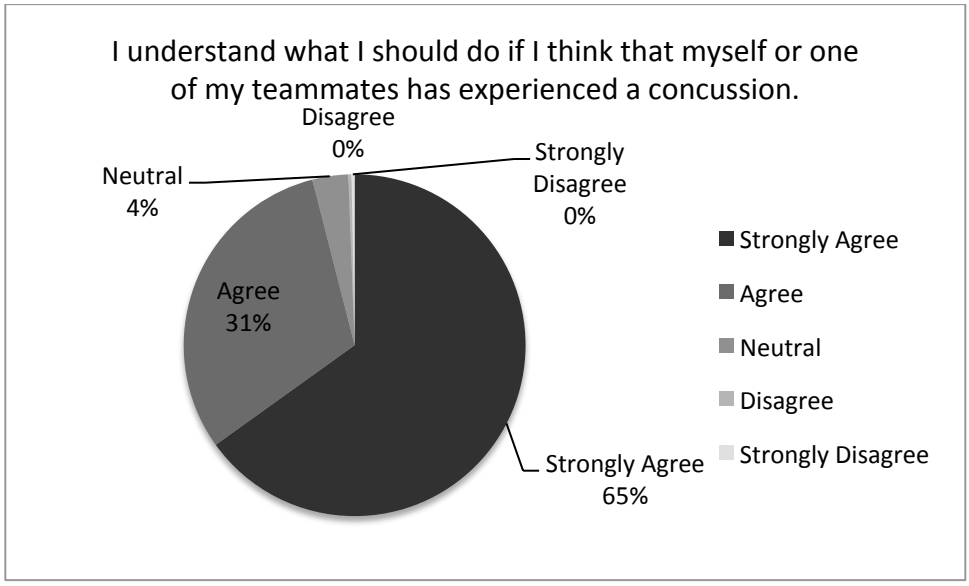

I feel that if a star athlete gets a concussion during a playoff game they should return to the game since it could be the last one of the season.
Strongly Agree 1%
Agree 3%
Neutral 9%
Disagree 38%
Strongly Disagree 49%
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

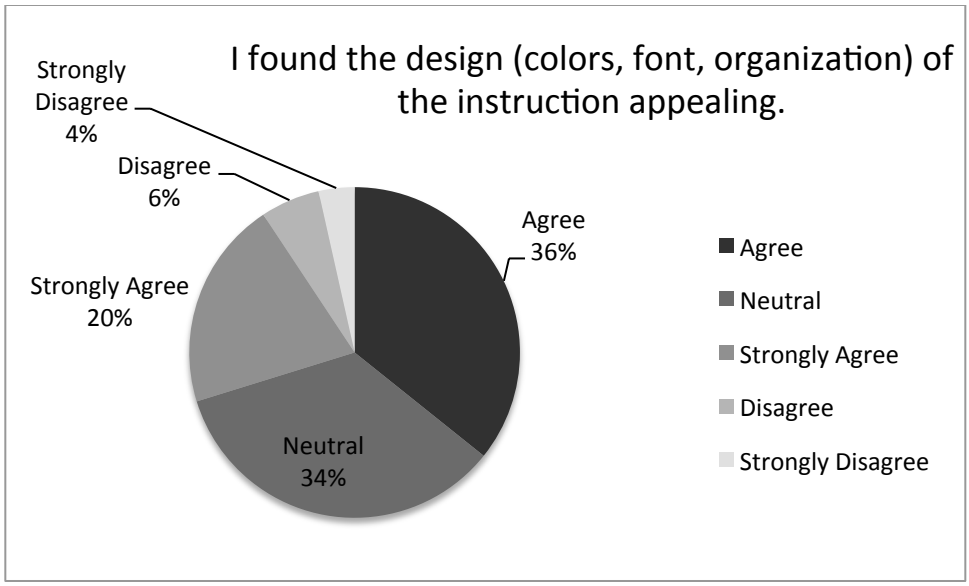

I feel that if I may be experiencing a concussion I should tell the coach or athletic trainer about my symptoms immediately.
Disagree 2%
Strongly Disagree 1%
Neutral 8%
Agree 41%
Strongly Agree 48%
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree

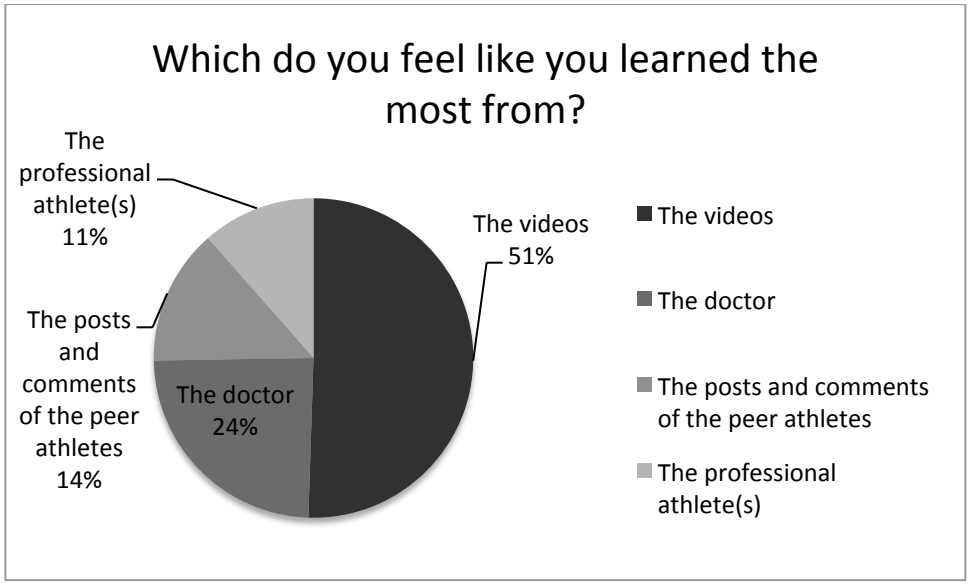
APPENDIX F

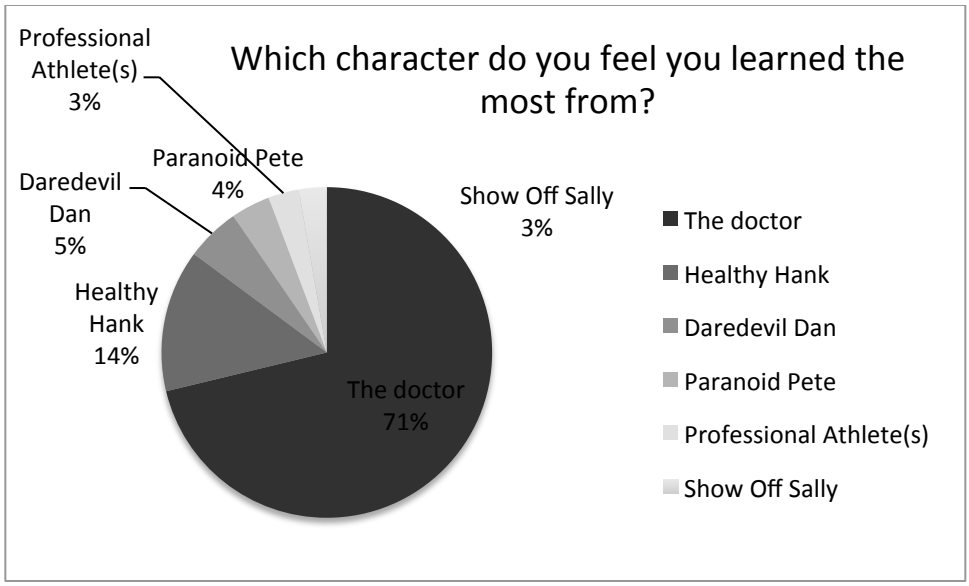
RESULTS OF PARTICIPANT POST-MODULE DESIGN SURVEY

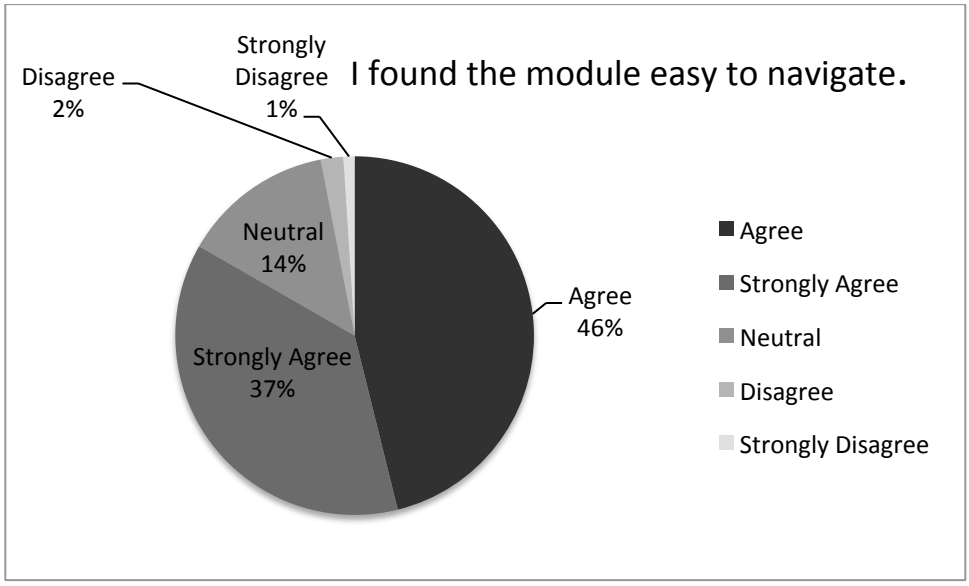

I feel like I learned something new I didn't know before about concussions.
Disagree 2%
Strongly Disagree 1%
Neutral 7%
Agree 36%
Strongly Agree 54%
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree

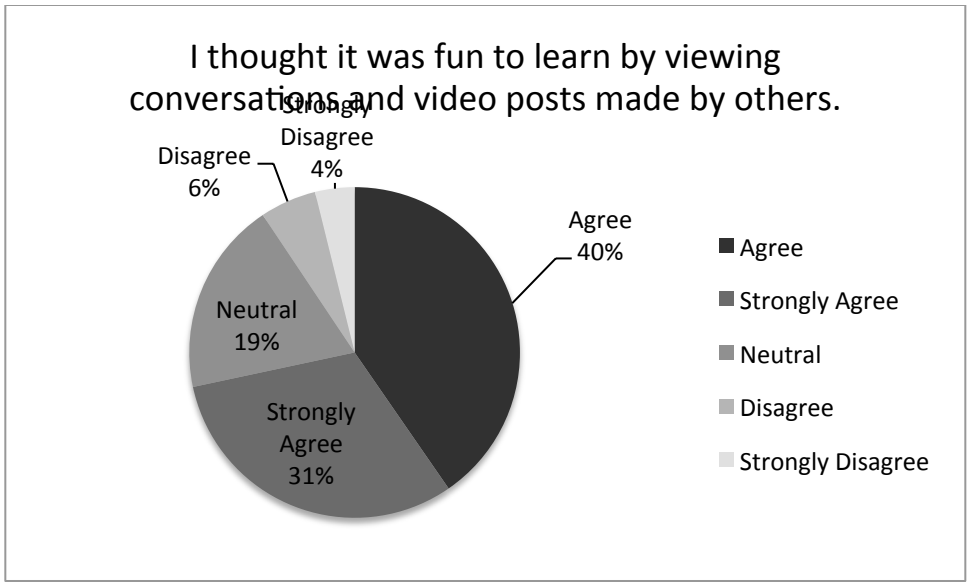

I understand what I should do if I think that myself or one of my teammates has experienced a concussion.
Disagree 0%
Strongly Disagree 0%
Neutral 4%
Agree 31%
Strongly Agree 65%
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree

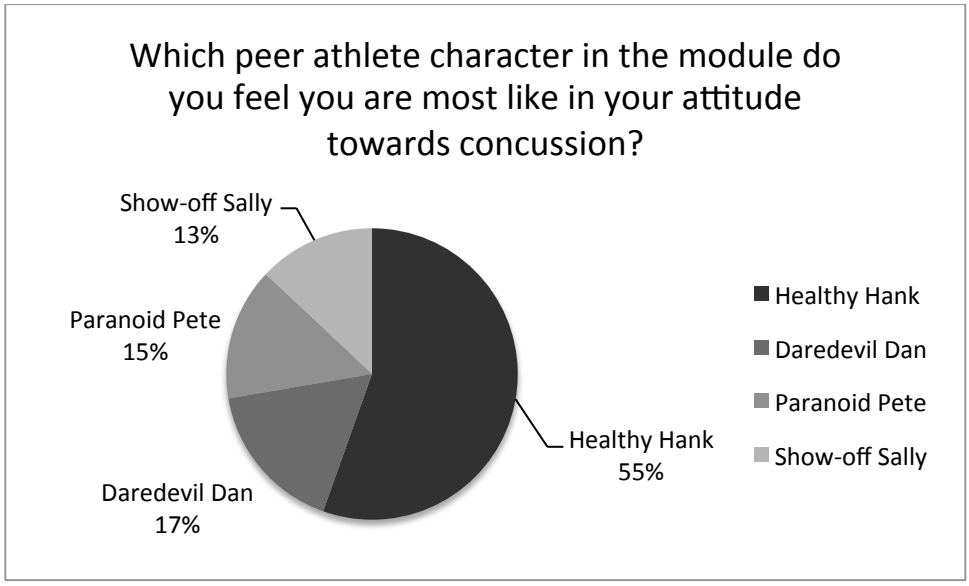

I found the design (colors, font, organization) of the instruction appealing.
Strongly Disagree 4%
Disagree 6%
Agree 36%
Strongly Agree 20%
Neutral 34%
Agree
Neutral
Strongly Agree
Disagree
Strongly Disagree

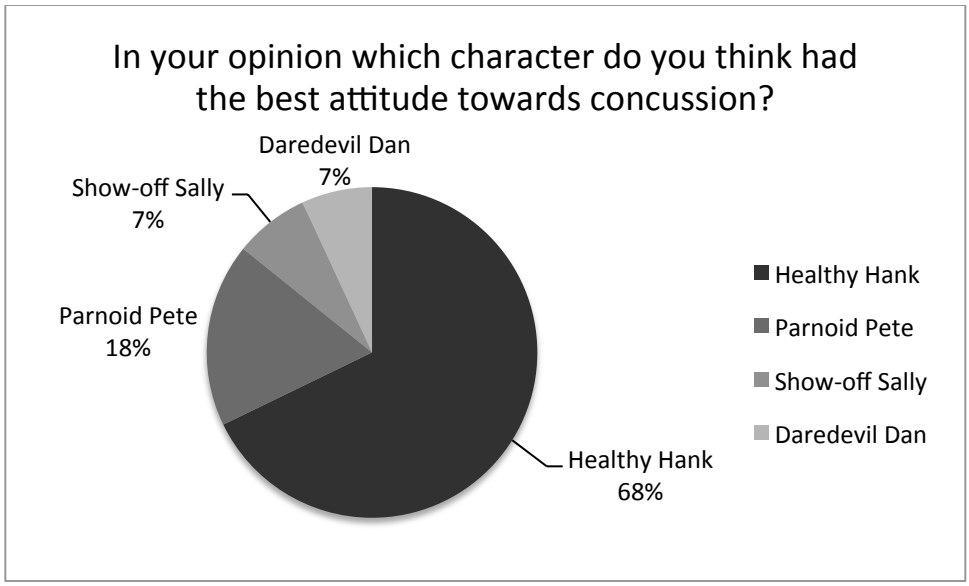

Which do you feel like you learned the most from?
The professional athlete(s) 11%
The videos 51%
The posts and comments of the peer athletes 14%
The doctor 24%
The videos
The doctor
The posts and comments of the peer athletes
The professional athlete(s)


Which character do you feel you learned the most from?
Professional Athlete(s) 3%
Paranoid Pete 4%
Daredevil Dan 5%
Healthy Hank 14%
Show Off Sally 3%
The doctor 71%
The doctor
Healthy Hank
Daredevil Dan
Paranoid Pete
Professional Athlete(s)
Show Off Sally


I found the module easy to navigate.
Disagree 2%
Strongly Disagree 1%
Neutral 14%
Agree 46%
Strongly Agree 37%
Agree
Strongly Agree
Neutral
Disagree
Strongly Disagree


I thought it was fun to learn by viewing conversations and video posts made by others.
Strongly Disagree 4%
Disagree 6%
Agree 40%
Neutral 19%
Strongly Agree 31%
Agree
Strongly Agree
Neutral
Disagree
Strongly Disagree


Which peer athlete character in the module do you feel you are most like in your attitude towards concussion?
Show-off Sally 13%
Paranoid Pete 15%
Healthy Hank 55%
Daredevil Dan 17%
Healthy Hank
Daredevil Dan
Paranoid Pete
Show-off Sally


In your opinion which character do you think had the best attitude towards concussion?
Daredevil Dan 7%
Show-off Sally 7%
Parnoid Pete 18%
Healthy Hank 68%
Healthy Hank
Parnoid Pete
Show-off Sally
Daredevil Dan

APPENDIX G

DETAILED DESIGN DOCUMENT

Detailed Design Document

Keep Your Head in the Game:

Concussion Training for High School Athletes

Submitted by the
Instructional Design Team

February 21, 2011

Overview

Course Title	Keep Your Head in The Game: Concussion Awareness Training for High School Athletes
Course Duration	• Approximately 50 minutes

Course Goals	• To promote student understanding and attitudes related to:
	  ○ Concussion awareness and preventative measures
	  ○ Identifying injuries in self and team mates that may result in concussion or related health concerns
	  ○ Proactively seeking treatment and adhering to doctor's treatment plan

Performance Outcomes	• To educate high school athletes about the causes and effects of concussions • A change in attitude and behavior related to the perception, recognition, and care of head injuries
Target Audience	• High School Athletes
Prerequisite Skills	• Basic web access/computer usage skills • At least a 5th grade reading level targeted to average reading level of high school students
Min/Max # of Participants	• Minimum: 1 • Maximum: Unlimited
Delivery Method	Stand-alone e-Learning course built using Articulate, Flash and HTML with basic SCORM compliance.
Contacts	**Project Manager**, Angela Barrus, <albarrus@asu.edu> **Lead Instructional Designer**, Renee Pilbeam, <rpilbeam@asu.edu> **Instructional Designer**, Quincy Conley, <quincy.conley@asu.edu> **Senior Developer**, Robert Christopherson, <rmchris3@asu.edu>
Resources	List of resources to be used during this course include: • http://www.cdc.gov/concussion/HeadsUp/online_training.html • http://www.nfhslearn.com • Stock and custom video footage provided by St. Joseph's Hospital • Subject Matter Expert "role model" video footage, including professional athletes and doctors specializing in concussion diagnosis and treatment

Needs Analysis

Findings	The needs analysis was conducted by reviewing the survey and data produced by a dissertation study conducted by Rosenbaum (2007). This study investigated athletes' and non-athlete's knowledge and attitudes about concussion injuries and their implications and determined that overall the target population had relatively low awareness and knowledge about the concussions and related injuries and their potential severity and consequently they viewed these injuries as relatively unimportant. This could be due to several factors 1) youth and the enhanced ability of their bodies to heal, thus, any injuries that may have been sustained likely healed relatively quickly without any chronic effects; and/or 2) the well documented sense of invincibility (i.e., immunity from negative events) that adolescents often possess (Rosenbaum,2007). The findings of the study suggests that an extensive educational intervention is necessary to disseminate information about concussion to athletes and to their support networks with the hope of reducing the prevalence of concussions, multiple concussions, and chronic and catastrophic concussion outcomes (Rosenbaum, 2007). This needs analysis data has informed our course objectives and overall course design structure. The course is focused on increasing awareness and shifting high school athlete attitudes about the seriousness of concussions and related injuries and provide them engaging and informative interactive learning that they can use to be more aware of potential injuries in themselves and their team mates while maintain a positive performance mentality and goal orientation. *Rosenbaum, A. M. (2007). An examination of the knowledge about and attitudes toward concussion in high school athletes, coaches, and athletic trainers (Docotoral dissertation). Retrieved from ProQuest. (AAT 3299046).*

Learner Analysis

Audience Profile	• Approximately 100,000+ high school athletes
Location and Population Size	• Greater Phoenix metropolitan area
Demographic Factors	• Male and Females • 14 to 20 years of age
Learner Aptitude Regarding Course Content	• Learners are somewhat familiar with the topic of concussions, however, may not understand medical terms • Learners while somewhat familiar with the topic may lack understanding of the severity and long term consequences of failing to take precautions to avoid concussions and to recognize and treat them should they occur • Learners are competitive and desire to be their best. This aptitude and attitude can help or hurt them when it comes to taking care of their own health. We hope to channel this attitude by deepening awareness and understanding and teaching players about the actions they can and should take to protect themselves and their team mates while maintaining a positive, competitive spirit of doing and being their best on and off the field.
Learning Environment	• Learning will take place in high school computer labs on desktop or laptop computers ○ Speakers or headphones
Computer Abilities	• Basic web access/computer usage skills
How should we refer to the audience?	• In order to help athletes understand that this topic is relevant to them we will use personal pronouns (i.e. you, we) to address the audience and personalize the content as much as possible
From whom or what does this instruction come?	• St. Joseph's Hospital and Medical Center • http://www.cdc.gov/concussion/HeadsUp/online_training.html
What is the intended shelf life for this course?	• Two years

Graphic Treatment

How should we brand the course and/or supporting materials?	• St. Joseph's Hospital and Medical Center • Arizona Cardinals

What guidelines, stock images, and other graphical resources exist for use of branding logos, color scheme, fonts, etc?	• High School Athletes
	  ○ Football
	  ○ Basketball
	  ○ Soccer
	  ○ Volleyball
	  ○ Hockey
	• Color Scheme: Red and white affiliating with both St. Joseph's and the Arizona Cardinals

What types of visual elements are desired (photography, animation, and/or video)?	• Use as much diversity as possible • Try to recreate real-life circumstances if possible • Use visual elements that have "Facebook-like" functionality and profiles to present the content to the intended demographic in a manner that is meaningful, interesting and engaging to them • Create "peer profiles" and positive "role models" including current athletes and doctors for the students to learn from as they proceed through the course

Course Outline

Topic	Content	Methods
Course Introduction	A brief introduction and overview of the course.	E-Learning welcome screen that presents "Brain Book" as a parody of Facebook to create an engaging instructional delivery system. The elements of the social network will be leveraged to deliver concussion instruction but no social networking will actually occur. See the attached PowerPoint to review the sample framework.
Profile Pretest	• Initial" Brain Book" concussion attitude survey presented • Friend finder appears • Friend request from individual closest to their initial attitudes sends participant to first instructional profile screen.	Scenario and profile-based e-learning screen to measure athletes' baseline knowledge about concussions.
Learning Objectives	By the end of this demonstration, you will be able to: • Explain what a concussion is and the potential consequences of this injury. • Recognize concussion signs and symptoms and how to respond. • Describe the steps for returning to activity (play and school) after a concussion. • Explain prevention and preparedness to help keep athletes safe season-to-season.	Following the profile pretest, the participant will be shown the training objectives within the "Brain Book" framework along with their "Friends" listed on the page that will comprise the instructional profiles used throughout the course. Participants will select each of their "Friends" to review a short profile of that person that includes descriptive items such as: • Activity/Sport • Likes • Dislikes • Pages/Items this person is a "Fan of" • Other "Facebook"

	Topic	Content	Methods
			type profile items
	Concussion Basics	Describe what happens to the brain during a concussion: • Definition of a concussion • Identify what causes a concussion	E-Learning screen with text and narration, supported by graphics, video and other animation presented in the "Brain Book" framework. **Interactive Deliverables** • Like/Dislike friend and role model posts • Watch videos presented by role model experts such as doctors or pro football players or visit web sites and "Become a Fan" if aligned with proper attitudes.
I	**Recognize and Respond to a Suspected Concussion**	Describe what to look for and when to pull athletes out of play: • Watch for danger signs and seeking immediate medical attention, and • Learn the four-step, "Heads Up" action plan when a concussion is suspected	E-Learning screen with text and narration, supported by graphics with animation. **Provide Interactive Scenarios** in the "Brain Book" framework for up to 8 athletes contributing posts, sharing videos and websites on the "News Feed" instructional pages. Profiled peers will move along the concussion attitude/awareness continuum as well as the goal orientation/performance continuum. Sample profiled peers may include: • "Daredevil" Dan: High goal/performance orientation, low attitude/awareness. Concerned with looking out for self. • "Cheerleader" Christy: High

Topic	Content	Methods
		goal/performance orientation, low attitude/awareness. Concerned with influencing others. • "Skater" Stevo: Low goal/performance orientation, low attitude/awareness. Concerned with influencing others. • "Mountain Bike" Molly: Low goal/performance orientation, low attitude/awareness. Concerned with looking out for self • "Klutzy" Kate: Low goal/performance orientation, high attitudes/awareness. Concerned with looking out for self. • "Paranoid" Pete: Low goal/performance orientation, high attitude/awareness. Concerned with influencing others. • "Healthy" Hank: High goal/performance orientation, high attitude/awareness. Concerned with influencing others.
Helping Athletes Get Back to Play and to School	Characterize the gradual steps for returning to activity (play and school): • Review a concussion preparedness checklist to guide you through pre-, mid-, and post-seasons	E-Learning screen with text and narration, supported by graphics with animation. **Interactive Deliverables** Include sample graphics of the following deliverables to

Topic	Content	Methods
		help orient the learner: • A Concussion Preparedness Checklist delivered by a Role Model coach in the "Brain Book" framework. **Potential Camera Man Activity** Given examples of their "Brain Book" friends' condition, learners will identify the one that is most ready to return to play and school. The learner zooms in on each thumbnail for a more detailed view in a popup window and votes using the thumbs up and thumbs down and potentially posting a comment. If the learner gets stuck, they can click on the camera icon for a hint.
Profile Post Test/ **Other Resources**	Provide additional concussion information, videos, and presentations by leading experts, fact sheets, and communication strategies for talking with parents and athletes, and other tools.	E-Learning screen with text and narration, supported by graphics with animation. **Become A Fan Final Assessment** Learners will be presented posts and asked to like/dislike, Become a Fan or Block. The scores on this posttest will be matched with the pretest scores and the athlete will be presented with a final summary of his/her attitudes and some reminders for playing to win but being safe.

	Topic	Content	Methods
	Summary	A brief conclusion of what was covered in the course.	Final “Brain Book” news feed screen that provides a final look at “Healthy” Hanks postings that remind athletes of learning objectives and model correct awareness/attitudes and understanding of concussions.

Issues Log

Issue	Owner	Date Identified	Date Resolved
Video brainstorming to inform script/storyboard creation.	Angela Barrus/Javier Cardenas	2-15-11	Planned deadline 3/2/11
Discuss stock video footage	Angela Barrus/Javier Cardenas	2-16-11	Planned deadline 3/2/11

Next Steps

- Identify and collect any stock video footage of doctors and role model athletes
- Create a detailed story board in PowerPoint that includes graphic treatment in preparation for creating the prototype in Articulate that will include interactions/animations.

APPENDIX H

ARIZONA STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD

EXEMPT STATUS

ASU Knowledge Enterprise Development

Office of Research Integrity and Assurance

To:	Brian Nelson EDB
From:	Mark Roosa, Chair Soc Beh IRB
Date:	07/06/2011
Committee Action:	**Exemption Granted**
IRB Action Date:	07/06/2011
IRB Protocol #:	1105006433
Study Title:	Concussion Awareness Education: A Design and Development Research Study

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(1) .

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that if disclosed outside the research, it could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

You should retain a copy of this letter for your records.

LIST OF FIGURES

Figure 1. A screenshot of the Brainbook module interface.

Figure 2. A screenshot of Brainbook showing video, like/dislike, and commenting capabilities.

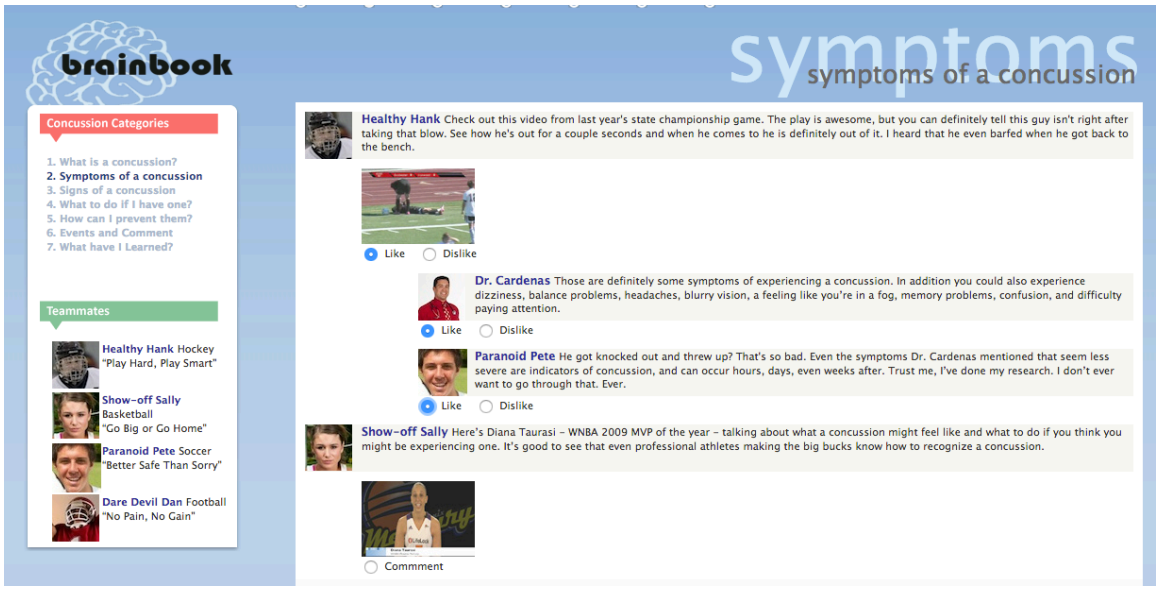


Figure 3. Design Decision Flowchart.