THE IMPACT OF AUGMENTED REALITY ON PRESERVICE EDUCATIONAL LEADERS' SELF-EFFICACY

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Abstract: The purpose of this study was to explore the ways in which augmented reality (AR) learning materials helped to make case studies with richer media so that preservice educational leaders could prepare for increasing self-efficacy in learning educational ethics. Educational leaders sometimes have to face ethical dilemmas, but preparing preservice educational leaders in classrooms for these difficult situations is challenging. Case studies are often used to help preservice educational leaders "practice" making decisions under pressure, but simply reading a case study might not convey the intense pressure that ethical dilemmas could cause. Technology has the potential to make learning from case studies a more robust experience through multimedia platforms. AR has been implemented in classrooms to enhance learning by engaging students and reducing cognitive load in learning complex content. However, AR has not yet been investigated as a way to improve self-efficacy among preservice educational leaders in making decisions regarding ethical dilemmas. This study employed a convergent mixed-methods design to collect data from pre- and post- surveys and individual interviews. Participants were 17 graduate students in the educational leadership program, and 14 of them agreed to be interviewed. The survey results showed that there were no significant differences in preservice educational leaders' self-efficacy levels through the AR intervention. However, the interview findings highlighted potential factors for using AR to promote preservice educational leaders' self-efficacy. This study can contribute to research in multimedia instructional design by giving guidance on how AR enhances the media richness of case studies for learning to manage difficult workplace scenarios.

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CHAPTER I

INTRODUCTION

Educational leaders face ethical dilemmas on a regular basis (Denig & Quinn, 2001; Greenfield, 1991; Karayama, 2018). For the purposes of this study, an ethical dilemma is defined as "a situation in which a difficult choice has to be made between two courses of action, either of which entails transgressing a moral principle" (Oxford English Dictionary, n.d.). Ethical dilemmas that educational leaders might face in their work setting are, for example, issues related to facing inappropriate student behavior, dealing with staff underperformance, allocating funding over competing areas, and confronting conflicts among the school community, parents, and citizens groups (Cranston, Ehrich, & Kimber, 2006). Some ethical dilemma decisions may be challenging, but educational leaders have to find the best solution for their institutions. In order to make the right decisions, they must consider the ethical consequences of the decisions made. A strategic direction for the institution is mainly based on moral foundation, mission or purpose, learner outcomes, and the vision of the institution (Beck, 1994). According to Schwahn and Spady (2010), leaders should align their strategic directions with people, processes, policies, practices, and structures of the organization. Authentic leaders who serve the organizations with truthfulness and integrity model the moral core values of their organizations. The moral foundation of authentic leaders includes key values such as: honesty, reflection, contribution, clear communication, and connections. In order to deal with change or an unexpected situation, educational leaders should believe that they can overcome problems (Schwahn & Spady, 2010).

Thinking that they have the capability to achieve their goals in a given situation is related to the term "self-efficacy" in cognitive psychology (Bandura, 1990). Preservice educational leaders who have no experience solving ethical dilemmas may encounter big challenges that require them to employ leadership skills (Beck, 1994; Essex, 2016). They need to learn how to face ethical dilemmas and respond appropriately to educational issues or unexpected situations (Alexander, 2009; Essex, 2016). However, solving ethical dilemmas is difficult before they have experience in administrative roles (Cranston et al., 2006; Davies & Heyward, 2019). Teaching about solving ethical dilemmas in the classroom is difficult because preservice educational leaders do not have experiences with ethical situations in a school setting. Getting this kind of practice in the classroom can be challenging. Nevertheless, the case study approach has been introduced to the classroom as a teaching technique that helps students learn this kind of skill because it offers authentic cases that they can learn in the real world (Pijanowski, 2017). Additionally, case studies do not cause unnecessary pressure for students because students do not have to face a real-life situation (Bignell, 1999; Choi & Lee, 2008; Myran & Sutherland, 2016). Giving students authentic and rich experiences can prepare them later on for solving challenging ethical dilemmas (Kirby, Paradise, & Protti, 1992; Surface, 2009).

Culture may affect perceptions of ethical dilemmas. Johnson (2018) claims that cultures shape how moral foundations are used, highlighting one or more ethical values over the others. For example, residents in Asia are more concerned with loyalty and purity than those in Western societies. However, according to Haidt, there are five common moral systems to consider when approaching diverse groups including harm/care, fairness/reciprocity, in-group/loyalty, authority/respect, and purity/sanctity. Every culture has virtues relevant to fairness and justice. In many cultures, people expect good leaders and feel respect and admiration for them.

Technology can provide authentic experiences that can help create realistic simulations of the real-world environments (Choi & Lee, 2008; Saltan, Özden, & Kiraz, 2016). One way to simulate learning experience in the classroom by using Augmented Reality (AR) (Green, McNair,

Pierce, & Harvey, 2019; Hsu, Lin, & Yang, 2017; Papanastasiou, Drigas, Skianis, Lytras, & Papanastasiou, 2019; Vallera, 2019). AR is an emerging technology that can help augment authentic simulations. AR enables users to see virtual objects on a mobile screen over a real world setting and interact with multimedia learning content. Users can use an AR application on a smartphone or a tablet to trigger an AR code on a handout or textbook. AR can be used to provide case scenarios through simulative experiences and case study videos. The researcher has come to the conclusion that if preservice educational leaders have challenges learning about decision making regarding ethical dilemmas and AR could provide environments that assist them, then more research must be conducted about how AR learning environments affect the perception of preservice educational leaders' self-efficacy.

In this study, an augmented reality application provided multimedia instructions that equipped preservice educational leaders to make decisions in unexpected circumstances by learning from various scenarios where they observed and learned from role models. The application provided users an opportunity to make decisions and see the consequences of their choices. This application provided users with videos, content, and other resources that they could review and interact with on their own path. Users could use a smartphone or a tablet to scan an AR code on a worksheet or a textbook. Afterwards, multimedia instructions displayed on a device screen immediately. Users would see and interact with multimedia instructions over a worksheet in the real world. Users would experience immersive learning environments and see possible consequences of their decision making. This study focused on the use of AR to support preservice educational leaders' self-efficacy in decision making regarding educational ethics.

Research Problem Statement

In recent decades, leaders in the United States public school systems have encountered unprecedented challenges to meet the needs of state and federal requirements to raise the standard of student academic success and close the gap of ethnic or racial achievement (Gilbert, Voelkel,

& Johnson, 2018). The decision-making processes regarding how to address these challenges are crucial for the credibility of institutions and leadership success. As established in Leithwoods' research, decisions made by school leaders are essential keys for the success of schools (Leithwood et al., 2004). Despite this understanding, many educational leaders step into positions unprepared for ethical dilemmas that they will inevitably face (Beck, 1994; Cranston et al., 2006). Preservice educational leaders are struggling in learning how to address ethical dilemmas because it causes them to make difficult decisions to decide what is the right action to take in order to handle the dilemma (Cranston & Kusanovich, 2013). In complex situations, it may not be easy to decide what option is right or wrong. Nevertheless, a significant part of being a leader is to be able to deal with stresses and have to make tough ethical decisions (Cranston et al., 2006).

There is very little research on the self-efficacy of preservice educational leaders before they take their leadership position. However, research has shown that preservice teachers lack self-efficacy and feel like they are not prepared for the conflict situations that they will face in the classroom (Beck, 1994; Davies & Heyward, 2019; Essex, 2016). The experiences of preservice educational leaders might be very similar to what we have seen with preservice teachers, and that is part of what this study addresses. Davies and Heyward (2019) claim teachers feel impotent and lacking strategies to confront ethical dilemmas. While interest in ethics and morals in educational settings has continually increased in the past 30 years (Davies & Heyward, 2019), there is more need for teachers to receive assistance in addressing ethical dilemmas. The gap in teacher education programs still remains (Davies & Heyward, 2019). Davies and Heyward (2019) assert that only learning the principles of the codes of ethics in the classroom may not be adequate for preservice teachers to respond to ethical dilemmas. They strongly encourage a more practical way for preservice teachers to experience and examine the dilemma.

Research has shown that high levels of self-efficacy in educational leaders improves their performance in decision making (Cobanoglu & Yurek, 2018). Additionally, administrator's self-efficacy is a significant factor in that administrator's actual performance (Cobanoglu & Yurek,

2018). The school leader's self-efficacy contributes to the school's climate and cultivates actions that set conditions to improve the school. Often, the success of principals does not only come from skills and knowledge that they have, but also their self-efficacy (Versland, 2016). Therefore, it is important to provide educational leaders with opportunities to engage in rich media experience in problem solving to enhance self-efficacy to address these challenges. However, providing rich media experience to enhance problem solving skills is difficult for most educational leadership preparation programs. Preservice educational leaders currently learn to face ethical dilemmas through text-based case studies (Cranston & Kusanovich, 2013; Midlock, 2010; Strike, Haller, & Soltis, 2005). According to Pijanowski (2017), the approaches for teaching ethics in leadership programs are diversified but aim to address philosophy as the theoretical foundation and concentrate on practicing solving problems. Teaching strategies involve reasoning and reflective approaches. The trends in teaching ethics include students writing cases and dilemmas, reading about professional ethics, and discussing particular ethical principles or situations. Many professors agree that learning through case studies is the best approach to learn about managing schools (Cranston & Kusanovich, 2013). However, the traditional case study approach does not give preservice educational leaders a thorough experience of contextual details or real-life emotions (Cranston & Kusanovich, 2013).

Augmented reality (AR) is an emerging field that may offer promise for providing rich media experiences during leadership preparation. Although numerous studies have explored self-efficacy and its influences within institutional situations (Cobanoglu & Yurek, 2018; Federici & Skaalvik, 2011; Lewis & Jones, 2019), fewer studies have investigated the influence of augmented reality (AR) on leader self-efficacy to address leadership challenges. Specifically, understanding the influence of AR on leader efficacy to address problem solving associated with ethical dilemmas can help to build leadership capacity for preservice or beginning leaders. Because educational ethics serve a critical decision-making role in institutions and the role of educational leaders is to model ethical decision making, then more must be known about how AR

learning environments affect the perception of educational leaders' self-efficacy to make ethical decisions to promote school success. Therefore, the purpose of the study is to explore the influence of AR learning materials on preservice educational leaders' self-efficacy to make decisions in situations that involve educational ethics.

Research Questions

1. What is the influence of an AR application that provides rich media problem-solving experiences on preservice educational leaders' self-efficacy for addressing ethical dilemmas?
2. How do preservice educational leaders perceive the AR lessons and their effects on self-efficacy?
3. To what extent do the quantitative results on self-efficacy agree with the interview findings on preservice educational leaders' experiences with the AR application?

Importance of the Study

The findings from this study are intended to contribute to the field of educational technology, especially in the areas of emerging technologies and multimedia instructional design. This study can guide instructors and educational leaders in making decisions on utilizing augmented reality for educational activities. Additionally, this study can guide instructional designers to improve multimedia instructions and acknowledge the benefits and challenges of using AR as an educational resource. The improved AR learning materials can assist educational leaders in making decisions for their institutions. The improvement of the AR application does not only benefit users who learn about educational leadership, but also learners in various disciplines. The product of the AR application can be used for training learners in educational settings, as well as employees in industries or organizations.

Scope of the Study

The study focused on two graduate classes named *Leadership Theory and Ethical Decision Making*, taught to Master's graduate students, and *School Leadership, Culture and Ethics*, taught to doctoral students in an educational leadership program at one public university. It focused on a short-term intervention regarding one case study, which was a single lesson unit. The study focused on graduate students in the educational leadership program at a university level, but it did not include professional development opportunities for in-service educational leaders. The AR case study lesson in this research focused on ethical decision making. However, it did not particularly focus on other challenging situations that educational leaders faced.

Definitions of Terms

1. Augmented Reality refers to a system that "supplements the real world with virtual (computer-generated) objects that appear to coexist in the same space as the real world" (Azuma et al., 2001, p. 34).

    AR systems have the following features:

    i. Augmenting virtual objects in a real-world environment
    ii. Functions interactively in present time
    iii. Aligns virtual and real objects with one another (Azuma et al., 2001, p. 34)

2. Self-efficacy refers to "the personal judgement about one's capacity to adopt certain behaviors and actions in order to accomplish certain objectives and expected outcome" (Paraskeva, Bouta, & Papagianni, 2008, p. 1085). The psychologist Albert Bandura (1990) explains, "self-efficacy is concerned with people's beliefs in their capacities to mobilize the motivation, cognitive resources, and the course of action to exercise control over task demands" (p. 316). Self-efficacy can be enhanced by four informational sources

including (1) mastery experiences, (2) observing role models, (3) encouragement and social support, and (4) reinterpreting personal stress (Bandura, 1977).

3. Leadership is defined as the "exercise of influence in a group context" (Johnson, 2018, p. 202).
4. Ethics is defined as "judgements about whether human behavior is right or wrong" (Johnson, 2018, p. 202).
5. Ethics in educational leadership provide "principles to guide administrators toward morally sound decisions and continues with an examination of three ways this assumption has influenced efforts to prepare ethical leaders" (Beck, 1994).

CHAPTER II

REVIEW OF LITERATURE

Introduction

The purpose of this study is to explore the ways in which AR learning materials help to make case studies into a richer media, so that preservice educational leaders can prepare for increasing self-efficacy in learning educational ethics. The literature focuses on research and theoretical perspectives regarding the use of AR in learning and self-efficacy among educational leaders. The review is organized by analyzing, interpreting, and evaluating research literature relevant to the need of this study. The review is made up of theoretical frameworks, analyses of using augmented reality in education, methodological literature relevant to the study, synthesis research findings, and critiques of previous research. This review aims to highlight themes and gaps within the literature. The review includes five main parts: (1) ethical dilemmas in the workplace, (2) the use of case studies to help novices learn how to face difficult workplace situations, (3) self-efficacy, (4) a cognitive theory of multimedia learning, and (5) the use of AR to support learning.

Ethical Dilemmas in the Workplace

School administrators are often faced with ethical dilemmas regarding specific decisions or actions. They have to consider appropriate moral values to resolve these dilemmas (Denig & Quinn, 2001; Greenfield, 1991, p. 312; Karayama, 2018). However, some cases are hard to

manage. School leaders regularly experience conflict and frustration in resolving ethical dilemmas (Greenfield, 1991). According to Kirby et al. (1992), the term *moral dilemmas* is defined as "situations which concern what is right or just, cannot be settled simply by knowledge of the facts, and involve conflicting moral principles" (p. 25). This means that situations that school leaders deal with are complex and can be difficult to resolve. They have to consider moral aspects which can be challenging. As Greenfield (1991) addresses, "the moral dimension of the administrator's work-world is very complex" (p. 18). Greenfield (1991) characterizes ethical issues that the school principals experience into five types including dilemmas associated with (1) foundational ethical principles of conduct within the organization, (2) good practice standards rooted in the educational professions, (3) conflicts between organizational policies and considerations at the school level, (4) implementation of a preferred decision over alternative decisions, and (5) concerns about consequences of their decisions and actions.

Commitment to ethical standards has become a key element in the development of educational administrations. Leaders have to apply moral principles to particular situations (Denig & Quinn, 2001; Kirby et al., 1992). Solving an ethical dilemma requires choosing an appropriate moral value over other moral values. (Greenfield, 1991). Nevertheless, there has been a lack of programs or courses in ethics that train administrators to engage in resolving these issues (Boehm, Justice, & Weeks, 2009; Gross & Shapiro, 2014). Since considering ethical standards has been acknowledged as a main element of the development of educational leaders, courses in ethics are recommended to be taught. Teer and Kruck (2012) also mention that there is a need for college graduates who are trained to be ethical leaders who will maintain company ethical standards and improve the organizational system that will help employees behave ethically.

Importance of Solving Ethical Dilemmas

As the world advances, administrators sometimes have to face ethical challenges. They must acknowledge, accept, and openly embrace change (Beck, 1994). It is essential for leaders to

make strategic directions for their organizations because it affects the welfare of school participants as well as the school community and society (Beck, 1994; Greenfield, 1991). In other words, the outcomes of schooling not only impact individual students but also the larger community. Karayama (2018) claims that when leaders make decisions, ethical concerns should be considered at the forefront. Additionally, Beck (1994) asserts, "much of the recent attention to ethics has arisen in response to a growing awareness of the complex dilemmas facing educational leaders" (p. 3). Educational leaders must discover approaches to work with teachers, parents, and students involved in any dilemma. The author further states,

> Within their schools, they must cultivate a shared vision, meaningful and coherent professional and personal experiences, and a sense of membership in a community of learning with persons who may have some profound differences in living conditions, values, and beliefs. Complicating this challenge is the fact that many of the norms, ideals, and assumptions that once provided a fairly stable framework to guide leaders are under attack. (Beck, 1994, p. 3)

This means that school leaders must consider the elements such as a vision, community, and rules while making decisions. Beck (1994) explains the establishment of guidance or principles can direct leaders in resolving dilemmas and responding to conflicts and challenges. For example, school leaders can follow moral principles, policies and laws, or the codes of conduct as guidance during a process of decision-making. It is important for preservice educational leaders to be well-prepared to face real-world ethical dilemmas and respond properly to each situation (Beck, 1994; Surface, 2009; Teer & Kruck, 2012). Being aware of ethical considerations will help them think critically and find possible solutions that create positive outcomes (Beck, 1994). Developing the skills of resolving ethical dilemmas will prepare future leaders to solve real-life dilemmas that they will face on a daily basis in their schools (Surface, 2009; Teer & Kruck, 2012).

Challenges in Facing Ethical Dilemmas

The topic of ethical dilemmas has been addressed and discussed in educational leadership studies. However, preservice educational leaders who do not have experience in leadership roles in school settings may not be familiar with ethical dilemmas (Beck, 1994; Essex, 2016). This may lead them to face difficulty in learning the topic and lack of confidence in solving ethical dilemmas (Beck, 1994; Essex, 2016). Practicing appropriate decision making before they become principals or school leaders can be challenging in the classroom (Beck, 1994; Essex, 2016). Since preservice educational leaders have to deal with school board policies and laws at the local, state, and federal levels; they may need help analyzing the legal framework and acquire more resources to respond to particular cases. For example, those specific ethical cases are related to scientific-based solutions (Surface, 2009), educational policies (Roberts, Rogers, & Fier, 1997), professional code of ethics (Roberts et al., 1997; Surface, 2009), and legal standards or laws (Karayama, 2018; Roberts et al., 1997). Learning from school policies and laws alone can be overwhelming (Alexander, 2009). Preservice educational leaders need a practical guide that equips them to learn about school law and how to deal with challenging situations that can happen in the real world (Alexander, 2009; Essex, 2016).

Preservice educators lack skills and self-efficacy in solving ethical dilemmas because facing complex dilemmas is challenging (Cranston et al., 2006) and they don't have experience in administrative roles (Davies & Heyward, 2019). Confronting ethical dilemmas is challenging for educational leaders because they have to make judgments ethically and consider the best benefit for students and staff. In some dilemmas, they have to decide what is the best benefit for an individual compared to the best benefit for the rest of the students and staff. Within complex circumstances or contexts, educational leaders may not easily discern what might be the right or wrong option. They have to deal with tensions and make tough decisions (Cranston et al., 2006). Another reason is that preservice educational leaders do not have experience in administrative roles. According to Cranston et al. (2006), preservice educational leaders preferred studying

ethical dilemmas with *real-life* scenarios since it could be a rich and powerful approach to develop practical skills and respond to dilemmas. However, the current ethics curriculum in educational leadership programs generally provides text-based case scenarios that preservice educational leaders only read the ethical principles and case studies (Pijanowski, 2017). Only learning ethical dilemmas in the classroom may be insufficient for responding to ethical dilemmas. Preservice teachers need a more pragmatic approach to experience dilemmas in teacher education (Davies & Heyward, 2019).

Core Value of Educational Leaders

The core values of leaders that employees look for the most are integrity or trustworthiness (Greenfield, 1991; Kouzes, 2011; Surface, 2009). As Surface (2009) states, "school administrators and teachers are among the most trusted individuals in the world" (p. 188). People expect educational leaders to have integrity and be trustworthy. In terms of educational leader preparation, the quality of integrity is an expected characteristic of the administrator (Greenfield, 1991). Kouzes (2011) asserts that credible leaders create a positive impact among people's lives as well as in the workplace; they build trust among their employees. To gain and maintain credibility, leaders should get to know their staff. Credible leaders should inspire commitment and loyalty. The behavior of personal credibility is "Do What You Say You Will Do" (Kouzes, 2011) Additionally, credible leaders should represent their organizations, not only themselves. They should carry the shared values of their organizations (Kouzes, 2011). This core value builds trust within the organization.

Understanding good leadership roles can help preservice leaders make positive impacts on their organizations (Johnson, 2018). Johnson (2018) further illustrates a powerful parable between ethical and unethical leadership, "According to Palmer, the difference between moral and immoral leaders is as sharp as the contrast between light and darkness, between heaven and hell" (p. 32). This means an ethical leader can lead the organization to the "light" path. The

author addresses that “ethical leaders brighten the lives of those around them significantly by building trust, commitment, and satisfaction; by reducing negative behavior; and by increasing individual and collective performance” (Johnson, 2018, pp. 32-33). Leaders who make morally sound decisions will lead the organization towards a more positive direction.

Making good decisions requires a leader’s personal belief that employees will be able to take actions and accomplish goals that a leader set. Leaders can improve the school by creating a vision and empowering members to take actions and accomplish the set goals. One of the important skills that contribute to leader success is *self-efficacy* (Versland, 2016). Self-efficacy is significant to leader success because it is the belief in an individual’s ability to accomplish particular tasks and contribute desired outcomes. Principals are expected to have high self-efficacy to facilitate organizational goal attainment. Self-efficacy enables a school leader to reach a high performance level to improve the school (Versland, 2016). The next section will explain the definition of self-efficacy and research relevant to self-efficacy in learning and educational leadership.

Self-Efficacy

In cognitive psychology, the term *self-efficacy* is related to people’s beliefs that they have the capability to achieve their goals in a given situation (Bandura, 1990; Cobanoglu & Yurek, 2018). The psychologist Albert Bandura (1990) explains, “self-efficacy is concerned with people’s beliefs in their capacities to mobilize the motivation, cognitive resources, and the course of action to exercise control over task demands” (p. 316). Additionally, Bandura (1990) addresses four principal ways to promote people’s beliefs in their perceived efficacy. The most effective way to develop a strong belief of efficacy is by *mastery experiences*. When people have gained the confidence that they have the ability to succeed, they persevere through hardship and quickly recover from obstacles. The second way of reinforcing personal beliefs of efficacy is through *modeling*. The models from other people can be sources of inspiration, interest, and skills. Seeing

other people's achievements can inspire the learner to increase his or her belief about self-efficacy. The third way to strengthen people's beliefs is through *social persuasion*. Social support and genuine encouragements can lead people to exercise more effort to boost their chances of achievement. The final way to modify self-efficacy beliefs is to develop stronger *physiological status*, decrease stress levels, or change the way people interpret their physical states such as reducing types of perceived weakness. For example, people can improve self-efficacy by managing their moods when facing challenged situations. When they experience failure, they can practice compassion for themselves.

An individual's self-efficacy beliefs influence the persistence and effort that they have in their work as well as the ability to recover from setbacks (Bandura, 1990; Lewis & Jones, 2019; Tschannen-Moran & Gareis, 2004). Bandura (1990) highlights that, "people's self-beliefs of efficacy determine how much effort they will exert in an endeavor, and how long they will persevere in the face of obstacles" (p. 317). This means that the stronger people believe in their abilities, the more they have persistence in their efforts. Strong perseverance usually leads to performance accomplishments. In the same way, Lewis and Jones (2019) claim that, "the greater one's sense of efficacy, the greater the effort, determination, and flexibility one will exert in a task" (p. 5). Self-efficacy relates to a task that can be evaluated in a particular context. Researchers generally measure participants' self-efficacy by asking them to evaluate their confidence to finish a task.

Self-efficacy beliefs have power to predict outcomes whether humans succeed or fail. People who have high self-efficacy have persisted through difficulties and finally achieve their accomplishments (Bandura, 1990; Federici & Skaalvik, 2011). High self-efficacy increases positive perceptions of an individual's own abilities and promotes intrinsic motivation. High self-efficacy also reduces anxiety and decreases the chance of a mental health disorder (Federici & Skaalvik, 2011). In contrast, people who have low self-efficacy quickly see themselves fail and show stress, frustration, and anxiety. They tend to depend on institutional and external bases of

power like positional, reward, and coercive power (Tschannen-Moran & Gareis, 2004). Low self-efficacy beliefs have been relevant to higher degrees of burnout, which associate with negative attitudes, depersonalization, and a lack of confidence when performing tasks.

Self-Efficacy in Learning

Federici and Skaalvik (2011) mention that in various studies, self-efficacy has been presented to predict behavior, cognitions, and emotions. For example, self-efficacy has been shown to positively impact learners' aspirations, goals, effort, choices, and persistence in facing academic performance and difficulties. Research also demonstrated that self-efficacy predicts teachers' motivation, goals, well-being and job satisfaction, as well as their students' achievement and motivation. Additionally, Bandura (1990) asserts that, "The stronger the perceived self-efficacy, the higher the goals people set for themselves and the firmer their commitment to them" (p. 320). This shows that self-efficacy beliefs influence personal goal setting. People's beliefs in their abilities impact their level of motivation as well as depression and stress they encounter with threatening circumstances.

Lewis and Jones (2019) state that, "many principal candidates enter the field with little to no experience in instructional coaching. This lack of experience may result in decreased self-confidence and uncertainty in the mind of the new administrator" (p. 2). Therefore, the authors propose that virtual instructional coaching can be a tool to help improve principal candidates' confidence in preparing them in the educational leadership program. Tschannen-Moran and Gareis (2004) also claim that, "training program structures should include mastery experiences, role plays, and positive persuasory messages to enhance novice principals' task-specific efficacy perceptions" (p. 383). Even though mastery experiences are considered as the most powerful element in self-efficacy, they may be hardest to deliver to principal who has a low self-efficacy.

Even though abilities are required for learning and performing, students also need motivation to learn. The self-efficacy theory is one of the motivational theories (McCollulm &

Kajs, 2009). Federici and Skaalvik (2011) assert that, “Self-efficacy beliefs foster intrinsic motivation and the ability to demonstrate involvement in various activities” (p. 577).

Self-Efficacy in Educational Leadership

Most efficacy studies of leadership have been significantly influenced by Bandura’s social-psychological theory of self-efficacy (1977). Self-efficacy beliefs have direct effects on leaders’ decision of activities. They also determine how much effort school principals will spend and how long they will persevere through difficulty or failure. Federici and Skaalvik (2011) define *principal self-efficacy* as, “the principals’ judgements of their capabilities to plan, organize and execute tasks and deal with their relationship to people and institutions in their environment” (p. 578). To clarify this, self-efficacy refers to leaders’ beliefs in their capabilities to succeed in tasks and courses of action to develop desired outcomes in the organizations. The improvement of self-efficacy beliefs can promote persistence and career interest.

Cobanoglu and Yurek (2018) assert that the success of the administrator leadership does not only depend on the ability that they have but also their self-efficacy beliefs. The effort that they will make in perseverance through challenges depends on their self-efficacy beliefs. Leaders who have high levels of self-efficacy beliefs make efforts to change the institution, look for innovations, and apply creative ways to reach their professional goals. Cobanoglu and Yurek (2018) define leadership self-efficacy as “the perceived ability of a person that s /he performs the required cognitive and behavioral tasks in order to reach the group goals” (p. 555). This means a leader’s self-confidence helps to lead a group successfully. In the same fashion, Federici and Skaalvik (2011) agree that self-efficacy is “vital to leaders’ success because it determines their effort and persistence to relation to a specific task as well as to the aspirations and goals they set” (p. 578). Leaders’ self-efficacy is significant because it influences the performance and attitudes of their followers. The beliefs of leaders’ self-efficacy also have a positive impact on staff

members' engagement and commitment to tasks in the organization. Principals' self-efficacy is an important key to manage schools (Federici & Skaalvik, 2011).

Additionally, principals' levels of self-efficacy impact the quality of supervision of teachers as well as the quality of instruction and students' learning (Federici & Skaalvik, 2011). Self-efficacy is viewed as a primary characteristic of an effective educational leader (Tschannen-Moran & Gareis, 2004). Duran and Yildirim (2017) report that, "the more the school administrators feel competent themselves, they more they have life satisfaction" (p. 225). This means that self-efficacy and life satisfaction correlate. In addition, self-efficacy perspectives of educational administrators predict the success of school leadership skills. Both self-efficacy beliefs and school leadership skills have a purposeful connection in a positive way (Duran & Yildirim, 2017; Leithwood & Jantzi, 2008; McCollulm & Kajs, 2009). School leaders can build trust through integrity, collective decision making, competency in responsibilities, and supportive behavior. High-trust schools demonstrate students' academic improvements (Wahlstrom & Louis, 2008).

Administrators' self-efficacy also relates to learning and teaching quality, school effectiveness, and efficient leadership. Educational leaders are expected to have a high degree of belief in self-efficacy so that they can perform their responsibilities well and have strong leadership skills to transform the organization in a better way (Cobanoglu & Yurek, 2018). Many studies report that there is a positive correlation between self-efficacy and engagement in the workplace (Cobanoglu & Yurek, 2018; Federici & Skaalvik, 2011; Leithwood & Jantzi, 2008; McCollulm & Kajs, 2009). This means that the success of the institution is affected by administrators' self-efficacy. School administrators with high self-efficacy are motivated to reach their goals and might be more qualified to be more successful and effective.

Self-efficacy is claimed to be relevant to goal orientation and efforts to reach set tasks (McCollulm & Kajs, 2009; Petridou, Nicolaidou, & S. Williams, 2014). A successful leader who has a high degree of self-efficacy has characteristics such as being goal-oriented, being good at

problem-solving, and having patience to perform (Cobanoglu & Yurek, 2018). Self-efficacy plays an essential role in the school because self-efficient administrators aim to accomplish the goals in spite of hard circumstances. Self-efficacy might affect motivation level, task performance, and self-development attempts in the institution (Cobanoglu & Yurek, 2018). High self-efficient leaders are likely to set more challenging aims, while lower self-efficient leaders avoid setting challenging goals. Setting a goal leads people to a purpose and shows them how it can be achieved (Petridou et al., 2014). Both goal setting and task direction are leader behaviors that relate to the development of leader's self-efficacy beliefs. The practices such as identifying a vision, enhancing the acceptance of the goal of the group, and establishing high performance expectations can help set dictions of the organization (Leithwood & Jantzi, 2008).

Measuring Self-Efficacy

Tools for measuring educational leaders' self-efficacy vary such as the Self-Efficacy Survey (Gilbert et al., 2018) and the School Administrator Efficacy Scale (SAES) (McCollum & Kajs, 2009). Gilbert et al. (2018) investigated how immersive simulations enhance educational leaders' self-efficacy and skills, particularly within the professional development program. They used the Self-Efficacy Survey to examine the impact of using immersive simulations as tools in the educational leadership training program. The pretest had Cronbach's alpha = 0.89 and the posttest had Cronbach's alpha = 0.92, which considered a high indicator of reliability (Cronbach's alpha ≥ .07) (Gilbert et al., 2018).

McCollulm and Kajs (2009) claim that there is a correlation between self-efficacy and goal orientations. They present the School Administrator Efficacy Scale (SAES), which includes eight dimensions of school administrators' efficacy. These dimensions are: (1) Instructional Leadership and Staff Development, (2) School Climate Development, (3) Community Collaborative, (4) Data-based Decision Making Aligned with Legal and Ethical Principles, (5) Resources and Facility Management, (6) Use of Community Resources, (7) Communication in a

Diverse Environment, and (8) Development of a School Vision (p. 30). The authors created questionnaire items related to these dimensions. According to the SAES, the *Data-based Decision Making Aligned with Legal and Ethical Principles* subscale of the questionnaire asks principals to agree or disagree with the listed questionnaire items:

- I can make sound decisions and am able to explain them based on professional, ethical and legal principles.
- I am confident in my ability to understand and evaluate education research that is related to programs and issues in my school.
- I am confident in my ability to apply appropriate research methods in the school context.
- I can explain to staff and parents how the decision-making process of my school district.
- I can explain to staff and parents how the governance process data to extract the information necessary for campus improvement planning.
- I can make decisions within the boundaries of ethical and legal principles.

  I am able to explain the role of law and politics in shaping the school community (McCollum & Kajs, 2009, p. 44).

This SAES scale is recognized as a valid measurement tool to evaluate school administrator's self-efficacy with 64.5% of explained variation and Cronbach's alpha: 0.83-0.95 (Petridou et al., 2014). Other than measuring tools that focus on educational leaders' self-efficacy, there are other ways to indicate user's technology effectiveness. For example, surveys that evaluate technology self-efficacy are Technology Self-Efficacy, Technology Response-Efficacy (Zhang et al., 2017), and Task Self-Efficacy (Holden & Rada, 2011). According to Zhang et al. (2017), the technology self-efficacy and response-efficacy scales are valid and reliable. The suitability of the surveys was ensured by assessing content validity and construct

validity. Reliability was assessed by composite reliability > 0.7000 and average variance extraction > 0.7000, which considered appropriate convergent validity. In the same way, Holden and Rada (2011) assert that the task self-efficacy survey has constructs that are showed statistically reliable. The Cronbach's alpha value was statistically appropriate for every evaluated construct. The correlation analysis showed constructs had significant, positive relationships ($p < .05$).

The Use of Case Studies to Help Novices Learn How to Face Difficult Workplace Situations such as Ethical Dilemmas

Case-based learning (CBL) has been used to advance the quality of higher education (Shi et al., 2017). Case studies were officially introduced and used in education at Harvard Law School in the 1870s. Afterwards, many medical and business schools had adopted and still currently use a case study approach (Bignell, 1999; Diamantes, 1996; Saltan et al., 2016; Shi et al., 2017). The case study is suitable and effective in applied fields since it provides real-life situations that can connect theory with practice in the real world (Grimes, 2019; Saltan et al., 2016). In the 1980s, instructors began to increasingly use case based learning in teacher education. Educators prefer using cases since they can reveal real-life situations through authentic cases in the classroom setting (Diamantes, 1996; Grimes, 2019; Saltan et al., 2016; Strangeways & Papatraianou, 2016). Students in fields such as medical, legal, business, and education can apply their theoretical knowledge to analyze cases and evaluate outcomes (Saltan et al., 2016).

Definition of Case Study

Case study refers to "a situation or event to be analyzed" (Diamantes, 1996, p. 5). Put in a simple way, Bignell (1999) defines a case study as "a story." The author further explains, "A story has a setting, characters, events, a plot and an ending. A case study has these too, with emphasis on the processes that occur in different strands of the story" (Bignell, 1999, p. 312). A

story usually ends with characters or plots coming together or may leave strands to the imagination. However, case studies are usually open ended and leave room for learners to design future hypotheses (Bignell, 1999). Case-based learning is also defined as "a cognitive model" (Japar, 2018). According to Japar (2018), case-based learning employs "constructivist pedagogy by developing students' knowledge from their experience" (p. 31). This constructivist pedagogy is correlated to the constructivism concept by taking into account students' examination of new information and connection to prior knowledge.

In the field of educational administration, Diamantes (1996) describes how case based learning can be a tool to "bridge theory with practice; develop skills such as critical thinking, problem-solving, decision-making; and practice reflection as an administrator" (p. 7). Case studies for educational administrators provide choices to leadership students. In fact, Diamantes (1996) points out that case studies are different from lived experiences because they bring relatively authentic experiences while providing examples of dilemmas.

Uses of Case Studies

Case studies have been used in various forms such as text-based, video-based, multimedia-based, and web-enhanced cases. Furthermore, various teaching approaches have been used, such as case discussion, case analysis, case development, and lately case-based reasoning (Saltan et al., 2016). Diamantes (1996) classifies case ideas into five categories, including textbook cases, casebooks, conversations and videotapes, subject-specific cases, and context-specific cases. Cases show a variety of theories and practices relevant to different topics. Learners can apply theory that they have learned into practice through case scenarios.

Indeed, the case study technique has been commonly used to teach ethics (Kirby et al., 1992; Roberts et al., 1997; Surface, 2009). Case studies enable learners to examine moral conflicts and evaluate their moral reasoning. Students can test their understanding about the dilemmas that they are likely to face in real life situations (Kirby et al., 1992; Surface, 2009).

Benefits of Case Studies

A unique characteristic of a case based instructional method is that it simulates real life situations. This teaching method brings reality and practice into the realm of theory. It provides learning content that most nearly resembles reality (Diamantes, 1996). Grimes (2019) asserts that a case study approach provides "rich descriptions of teaching and learning in classrooms that lead to enhanced applications of learned content" (p. 139). Real case studies develop students' analytical skills by giving vicarious experiences, so they can learn to make better decisions themselves (Bignell, 1999). Cases aim to illustrate real life situations within a learning context. It enables students to gain insights from difficult, real-life circumstances. It prepares students to deal with real-world problems and overcome those problems that they will encounter in their professional lives (Saltan et al., 2016).

Bignell (1999) emphasizes that case study approaches can be used for illustrating a consequence of an action or decisions made by people. A case provides vicarious experience through another person's circumstance. In other words, it allows students to imagine that they are in the situation and step into others' shoes. It also provides an opportunity to evaluate conditions in each case. In the same way, Strangeways and Papatraianou (2016) agree that preservice teachers need to engage with real teaching experiences, so they can be prepared for applying theory knowledge to practice in the placement setting. Case-stories can offer these engagements with 'real' meaningful experiences.

In addition, Buffington and Harper (2002) claim that case studies are a significant factor for teaching crucial professional issues because they provide students with a sample of real-world organizational issues. As in other fields, students in the educational leadership field will be faced with real-life situations once they become school leaders. Case studies in the field of educational leadership will provide students the ability to design and execute appropriate solutions to the problems that they will face. Case study offers a rich and complex sample of challenges in social justice and school improvement (Myran & Sutherland, 2016). Use of case study allows preservice

educational leaders to gain deeper understandings of knowledge through problem-based learning since it pushes students to consider the possible implications and apply course content to relevant realistic scenarios.

Besides providing authentic learning experiences, a case study is considered as a teaching strategy for a problem-based learning (PBL) approach. Grimes (2019) asserts that, "Case studies are one type of PBL that focuses on presenting students with difficult decision-making and problem-solving dilemmas that course content can help clarify how course content may translate into the real world" (p. 140). A case study is acknowledged in an educational field for its ability to develop students' knowledge and skills in conditional decision making (Strangeways & Papatraianou, 2016). Its compelling storytelling encourages students to be interested in and create their sense of urgency to solve the problem(s) in the case (Grimes, 2019).

Another reason teachers use a case study approach is because cases positively impact student motivation by grabbing their attention and maintaining high motivation in the class (Saltan et al., 2016). In the same way, Diamantes (1996) asserts that the case based learning yields student involvement and engagement since students get to interact with the situation. It encourages students to reflect on possible practices and deliberate actions. Japar (2018) reported that case-based learning in civic education increased student engagement. It allowed students to express their critical voice. Students looked engaged in learning activities and worked within a team to solve the problems. Additionally, Grimes (2019) asserts that case-based learning activities provide real-world application which causes a more engaging learning atmosphere. Students do not only perform with high standards but also enjoy learning course content.

One way to enrich case studies to be authentic is to use multimedia such as video, audio, and pictures (Saltan et al., 2016). As Saltan et al. (2016) mentions, case scenarios have been implemented in education in different formats such as text-based, multimedia-based, and web enhanced-based scenarios. The improvements of technologies such as websites and videos have enabled students to learn case scenarios from multimedia platforms. The researchers showed that

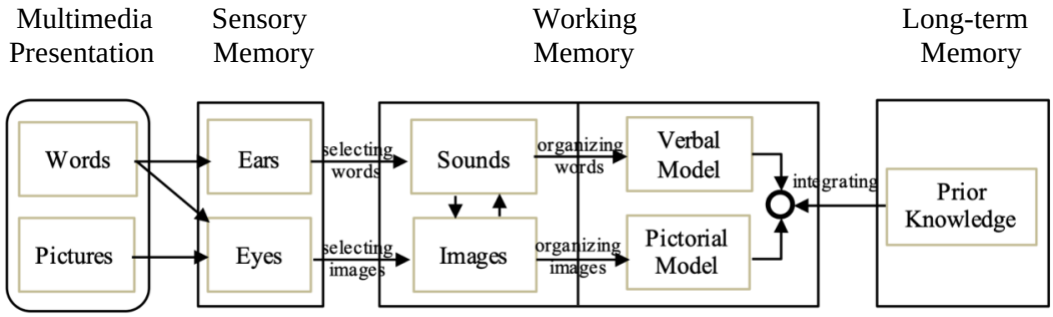
the majority of the students stated that video cases were authentic. In addition, preservice teachers, who watched video-based cases about observing classroom activities and misbehaviors, expressed the video cases to be realistic and enjoyable to watch. The next section will explain how learning with multimedia can enhance learning through the lens of the cognitive theory of multimedia learning.

The Cognitive Theory of Multimedia Learning

The cognitive theory of multimedia learning (CTML) (Mayer, 2014) presents the cognitive process relevant to learning in a multimedia environment, which involves selecting related information, organizing receiving information, and integrating new information with related prior knowledge from long-term memory (Mayer, 2014). CTML considers the work of the human mind and how it processes information during learning with multimedia materials (Jiang, Renandya, & Zhang, 2017; Mayer, 1997). Mayer (2001) proposes three assumptions of a cognitive theory of multimedia learning, which are (1) dual-channel assumption, (2) limited-capacity assumption, and (3) active-processing assumption. First, the dual-channel assumption is based on Paivio's (1986) *dual-coding theory* and Baddeley's (1992) *model of working theory*. Mayer (2001) explains that, "Humans possess separate channels for processing visual and auditory information" (p. 44). To clarify this, humans' sensory memory has two separate channels for receiving information from multimedia presentation. Those two channels are the visual channel (eyes) and the verbal channel (ears).

Figure 2.1

Cognitive Theory of Multimedia Learning (Mayer, 2001)

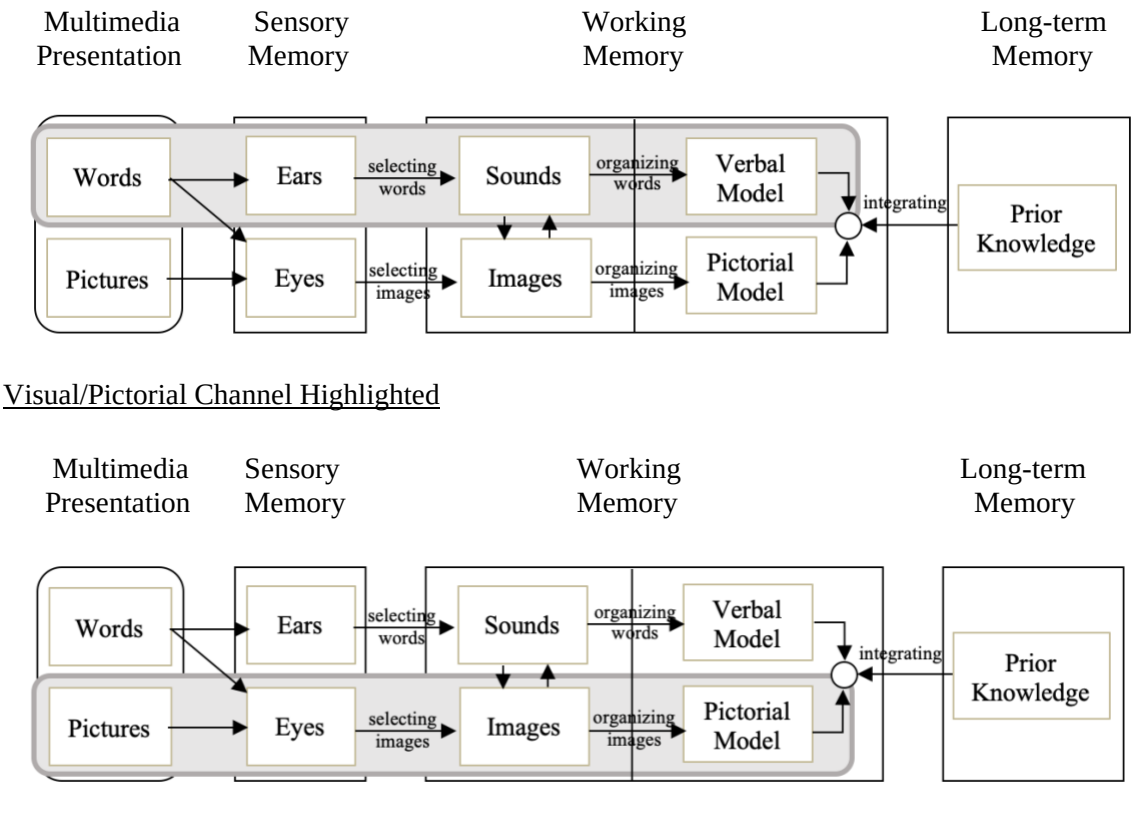


Note. From "Multimedia Learning" by Richard E. Mayer, 2001, p. 44. © Cambridge University Press 2001. Reproduced with permission of The Licensor through PLSclear.

Figure 2.1 illustrates *a cognitive model of multimedia learning*, which aimed to describe the system by which a human processes information. Boxes represent memory storages which include sensory memory, working memory, and long-term memory. Sensory memory is a location where a human receives spoken words, written words, or pictures through a human's sensory receivers, which as ears and eyes. Working memory is a location where a person processes the received information. Long-term memory is a location where a human collects large amount of prior knowledge. The CTML process starts from the left side. Humans receive words (including spoken or written words) and pictures from an outside source like a multimedia presentation and get into individual sensory memory via ears and eyes.

Figure 2.2

(A) *The auditory/verbal channel (Top Frame) and* ***(B)*** *visual/pictorial channel (Bottom Frame) in a cognitive theory of multimedia learning (Mayer, 2001)*



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According to Figure 2.2, sensory memory enables printed text and pictures to be held as visual images while spoken words and sounds are held as auditory images. The main work of multimedia learning occurs in working memory, which has a role for "temporarily holding and manipulating knowledge in active consciousness" (Mayer, 2001, p. 44). On the left side of the working memory box, information comes to the working memory through sounds of spoken words and visual images of pictures. Conversely, the right side of the working memory box is the knowledge that is constructed in the working memory. This includes both verbal and pictorial

models and connections between them. The last box is long-term memory, which can hold large quantities of knowledge in long time periods, and it needs to be brought into working memory (Mayer, 2001). The first assumption concludes that humans have two separated channels to receive a multimedia presentation. These channels are ears, which represent the verbal channel, and eyes, which represent the visual channel. The verbal channel processes spoken words, while the visual channel processes pictures.

The second assumption is rooted in Chadler and Sweller's (1991) *cognitive load theory*. The assumption is that, "Humans are limited in the amount of information that they can process in each channel at one time" (Mayer, 2001, p. 44). This means that the processing abilities of humans' verbal and visual memory systems are limited (Mayer, 2001; Mayer, Moreno, Boire, & Vagge, 1999). Mayer and Moreno (2002) claims that the cognitive load theory is a significant element in any learning theory that aims to guide the design of multimedia in educational settings. Therefore, instructional messages should be developed in ways that decrease the chances of overloading the student's cognitive system (Mayer, 2001; Mayer & Moreno, 2002).

The third assumption, drawn from Wittcrook's (1989) *constructivist learning theory* states, "humans engage in active learning by attending to relevant incoming information, organizing selected information into coherent mental representations, and integrating mental representations with other knowledge" (Mayer, 2001, p. 44). To clarify this, a learner first pays attention to related words and pictures in a multimedia instruction to build *a word base* and an *image base*. Then, a learner translates internal connections among words into a coherent pictorial model and pictures into a coherent verbal model. After that, a learner makes external connections between the pictorial and verbal models and with existing knowledge (Mayer, 2001; Mayer et al., 1999). This means that meaningful learning takes place when a learner creates relations between pictures and spoken words from a multimedia presentation.

To summarize, a cognitive theory of multimedia learning is guided by three main theories: (1) dual coding theory, (2) cognitive load theory, and (3) constructivist learning theory

(Mayer & Moreno, 2002). First, visual and verbal multimedia materials are processed in separated processing systems. Humans' eyes serve as the visual channel that receive information and produces *pictorial representations*, while humans' ears serve as the verbal channel that receives input in and produces *verbal representations*. Second, humans have limited capabilities to process learning in multimedia learning environments. Third, meaningful learning happens when students select related information, arrange it into meaningful representations, and connect with other knowledge (Mayer & Moreno, 2002).

Multimedia Learning

Multimedia learning refers to learning from both pictures and words. It includes learning environments in which instructions are presented multiple forms. For example, students receive information through both a visual and a verbal format. Multimedia learning includes materials such as textbooks that contain illustrations and texts, computer-based lessons that involve narrations and animations, and presentation slides in face-to-face class settings that show spoken words and graphics (Mayer, 1997; Mayer et al., 1999).

In order to improve understanding of how humans learn from pictures and words, Mayer (2001) classifies seven principles of multimedia design that contribute to a multimedia design learning theory. These principles can help develop the design of multimedia presentations, which contributes to the practice of multimedia in education. From the experiment studies, the results supported the predictions of how humans integrate verbal and visual presentations. In a practical view, the results show a group of seven foundational principles for the multimedia presentations design as in Figure 2.3.

Figure 2.3

Seven research-based principles for the multimedia presentations design (Mayer, 2001, p. 184)

1. *Multimedia Principle:* Students learn better from words and pictures than from words alone.
2. *Spatial Contiguity Principle:* Students learn better when corresponding words and pictures are presented near rather than far from each other on the page or screen.
3. *Temporal Contiguity Principle:* Students learn better when corresponding words and pictures are presented simultaneously rather than successively.
4. *Coherence Principle:* Students learn better when extraneous words, pictures, and sounds are excluded rather than included.
5. *Modality Principle:* Students learn better from animation and narration than from animation and on-screen text.
6. *Redundancy Principle:* Students learn better from animation and narration than from animation, narration, and on-screen text.
7. *Individual Differences Principle:* Design effects are stronger for low-knowledge learners than for high-knowledge learners and for high-spatial learners rather than for low-spatial learners.

Studies Relevant to a Cognitive Theory of Multimedia Learning

A cognitive theory of multimedia learning has been studied in various educational fields such as sciences (Mayer, 1997), computer science (Almasseri & Alhojailan, 2019), medical (Yue, Kim, Ogawa, Stark, & Kim, 2013), language (Jiang et al., 2017), and teacher preparation (Romig et al., 2018). Mayer (1997) and colleagues conducted research to help learners understand a scientific explanation of cause and effect in a particular system such as a pump, the human respiratory system, and the development of lightning storms. This research aimed to compare the problem-solving transfer performance between students who learned through visual and verbal content (or multiple representation group) and students who learned only verbal explanations (or single representation group). The teaching approach in this study included multimedia presentations demonstrated in both visual and verbal forms. Computer-generated animations were presented along with computer-generated narrations. The results showed that multimedia instruction was efficient with consistent evidence of multimedia effect. Students in the multiple representation group, which received instruction in both visual and verbal formats, generated creative ideas on the problem-solving transfer tests significantly higher 75% of median than

students in the single representation group who received only verbal explanations. There was a strong evidence in each of eight experiments from the problem-solving transfer tests that inserting a visual description to a verbal content significantly increased student understanding (Mayer, 1997). Mayer (1997) concluded, "contiguous presentation of visual and verbal material may be most important when the material is a cause-and-effect explanation of a simple system, when the learners are inexperienced, and when the goal is meaningful learning" (p. 18). In other words, multimedia can be helpful for students who are not familiar with the problem-based learning topic that has a cause-and-effect description. Students who received multimedia instructions demonstrated more competent problem-solving transfer performance than students in a single representation instruction group.

In another study, Mayer et al. (1999) reported that students who viewed an animation explaining how lightning formed or how car's brakes activated along with listening to a narration explaining step-by-step performed significantly higher on a retention test, a transfer test, and a matching test than those who received the entire narration before or after the whole animation. A retention test measured the ability to select relevant information. A matching test measured the capability to build referential connections. A transfer test measured the ability to create integrated mental models for transferring. This showed that students tended to create connections between pictures and narrations, which supported a dual-process model in working memory (Mayer et al., 1999). Additionally, Mayer and Moreno (2002) claim that "Computer-based multi learning environments – consisting of pictures (such as animation) and words (such as narration) – offer a potentially powerful venue for improving student understanding" (p. 107). This supported that multimedia instruction helped students understand the process of scientific systems.

In the medical field, instructors use animations to represent a complex concept or real-world phenomena. Animations enhance experiences that students can engage in and gain knowledge. This animation teaching approach promotes positive cognitive processing and helps facilitating learning (Yue et al., 2013). In an English as a Foreign Language (EFL) classroom in

China, students and teachers gave significantly high scores on evaluation of their attitudes toward the multimedia courseware (Jiang et al., 2017). In teacher preparation programs, preservice teachers agreed that students in the multimedia instruction who used Content Acquisition Podcasts (CAPs) outperformed the comparison groups. Those multimedia learning group students perceived less cognitive load and performed higher learning outcomes (Romig et al., 2018). Furthermore, in the immersive virtual reality science classroom, a virtual reality lesson that showed how the human body worked reported positive ratings of motivation and interest as well as higher scores on a test (Parong & Mayer, 2018).

To summarize, these studies demonstrate positive outcomes of multimedia instructions in different fields as they enhance students' understanding of complex content (Mayer, 1997; Mayer & Moreno, 2002; Mayer et al., 1999; Yue et al., 2013), reduce cognitive load (Romig et al., 2018), improve academic outcomes (Jiang et al., 2017; Parong & Mayer, 2018; Romig et al., 2018), and increase students' motivation and engagement in learning (Parong & Mayer, 2018; Yue et al., 2013).

CTML and Learning Impacts

Learning from multimedia instruction designed by the CTML can impact both lower and higher levels of Bloom's taxonomy (Almasseri & Alhojailan, 2019). Bloom's taxonomy is a framework that categorizes educational goals into six categories including knowledge, comprehension, application, analysis, synthesis, and evaluation. This framework was created by Benjamin Bloom and his collaborators in 1956, and it has been widely applied in teaching among K-12 school settings and higher education. In 2001, a team of cognitive psychologists, educational researchers, curriculum theorists, and assessment specialists created a revision of Bloom's taxonomy. The six categories were changed to label *action words* to explain the cognitive processes in dealing with knowledge. Those revised six categories are remember, understand, apply, analyze, evaluate, and create (Armstrong, 2016). The lower level of taxonomy

includes remember, understand, and apply. In contrast, the higher level of taxonomy includes analyze, evaluate and create (Adams, 2015).

Almasseri and Alhojailan (2019) conducted experimental research in a flipped learning-based classroom that implemented the cognitive theory of multimedia learning in the lesson. In a flipped classroom, students can learn by their own path regardless of their level of understanding and speed through the benefits from multimedia features. For example, students can pause, replay, rewind, and forward the lesson. The researchers asserted that a video tutorial was classified in the lower levels of Bloom's taxonomy including remembering and understanding. Dividing instructions into small serial chunks could reduce students' cognitive load problem. In contrast, classroom activities that encouraged students to apply, analyze, evaluate, and create were classified in the higher levels of Bloom's taxonomy. The active learning approach allowed students to improve their knowledge while a teacher provided assistances. Their studies showed that the application of CTML improves academic achievements in learners with lower levels compared to the higher levels of Bloom's taxonomy. They concluded that instructional video could greatly benefit students who learn to remember and understand new knowledge content. Even though learners with higher levels of Bloom's taxonomy revealed less significant change in academic achievements than the lower levels learners, the results reported that the multimedia learning in a flipped learning approach had a positive impact on learners' academic achievements in the higher levels of Bloom's taxonomy (analyze, evaluate, and create) (Almasseri & Alhojailan, 2019).

Moreover, a multimedia example, such as the function of the car's brake system or the lightning formation, is relevant to constructivist learning. Mayer et al. (1999) assert that, "Constructivist learning occurs when learners actively construct meaningful mental representations from presented information" (p. 638). Students connect the multimedia information that they receive with their relevant prior knowledge. A design principles of multimedia communication states that, "learners are better able to construct mental models when

corresponding visual and verbal representations in working memory at the same time" (Mayer et al., 1999, p. 638). This means that learners tend to build referential connections between the visual and verbal representations. In addition, a multimedia lesson with appealing graphics can increase student engagement (Mayer, 2014). According to Mayer and Moreno (2002), multimedia learning can assist students in different ways, including providing multimedia aid, contiguity aid, coherence aid, modality aid, and redundancy aid.

CTML and Augmented Reality

There is some research about the design and applications of augmented reality based on a cognitive theory of multimedia learning (Sommerauer & Müller, 2014; Wang, Huang, Liao, & Piao, 2018). Sommerauer and Müller (2014) found that museum visitors who experienced AR exhibits acquired more knowledge than the non-AR exhibits group. The AR exhibits group perceived AR as a helpful and preferable add-on for museum exhibitions. From the design principles, the authors claim that the design principles that are incorporated with AR application are: (1) multimedia principle, (2) the spatial contiguity principle, (3) the temporal contiguity principle, (4) the modality principle, and (5) the signaling principle. Sommerauer and Müller (2014) further explain:

1. The multimedia principle states that, "people learn better from words and pictures than words alone" Sommerauer and Müller (2014, p. 60). AR can perform in this principle by superimposing printed texts with digital multimedia content (such as adding videos in a printed textbook), or, conversely, by overlaying real-world objects with digital texts (such as showing labels when scanning on a target object).
2. The spatial and temporal contiguity principles mention that, "learning is enhanced when the space and/or time between disparate but related elements of information is minimized" (Sommerauer & Müller, 2014, p. 60). AR can apply to this principle by

enhancing learning through minimizing the distance and/or time for accessing different information between relevant virtual and physical objects.

3. The spatial contiguity effect states that learning is enhanced when "printed words are placed near rather than far from corresponding pictures" (Mayer, 2002, p. 133); and the temporal contiguity effect states that learning is enhanced when "corresponding narration and animation are presented simultaneously rather than successively" (Mayer, 2002, p. 133). AR can implement the contiguity principles by overlaying digital content onto real-world objects at the same time and through temporally and spatially aligning relevant real-world and digital information.
4. The modality principle states, "learning can be enhanced by presenting textual information in an auditory format, rather than a visual format, when accompanying related visual content" (Sommerauer & Müller, 2014, p. 60). AR can apply to the modality principle by presenting spoken text or rather showing printed text.
5. The signaling principle states, "people learn better when cues highlight the organization of essential information in a learning environment" (Sommerauer & Müller, 2014, p. 60) can apply to the signaling principle by guiding and directing users through geographic location information and digital triggers in learning environments. AR can highlight necessary information while learning activities.

These evidences showed that the design principles regarding the cognitive theory of multimedia learning supported the reason why AR helped improve learning. Additionally, Wang et al. (2018) discussed that AR technology enhanced learning experience by generating virtual objects in real-world environments. AR allowed students to see the coexistence of both virtual and real objects. This unique function helped students visualize abstract concepts and complex spatial relationships. The authors further discussed that appealing designs in AR could help increase students' cognitive engagement and maintain their attention. Since AR allowed visual instruction materials to be augmented over the real world, it could improve learning as described

by the CTML. The result showed that students in the AR-based environments achieved better learning outcomes than the traditional group-based environments.

The most relevant principle to the use of AR in this study is the *Multimedia Principle*, which states: "Students learn better from words and pictures than from words alone" (Mayer, 2001, p. 184). AR enables learners to access multimedia educational materials. In this study, AR provides various scenarios about educational ethics/laws that students can learn from. Learners can access videos and content on a tablet or mobile screen, which they use to scan an AR code within the textbook or handout.

Rich Media and Self-Efficacy

Rich media (Daft & Lengel, 1986) is defined as "the ability of information to change understanding within a time interval" (p. 560). In other words, communicating information in ways that clarify ambiguous contexts and allow people to reach an understanding in a short period of time is considered rich. Richness refers to learning ability of a communication (Daft & Lengel, 1986). Daft and Lengel (1983) developed a scale for measuring the characteristics of media richness, including medium, feedback, channel, source, and language. The highest level of information richness includes face-to-face medium, immediate feedback, visual and audio channel, personal source, and body and natural language. In contrast, the lowest level of information richness includes numeric formal medium, very slow feedback, limited visual channel, impersonal source, and numeric language. High media richness is preferred for messages that may be hard to understand or unclear, and therefore lead to multiple interpretations. When people use rich media such as face-to-face communication, over less rich media, such as written letter, they are able to communicate better. Richness of media can affect the way people communicate (Bergin, 2016).

In this study, the rich media experience provided by an AR app is proposed as a way to enhance learning, based on the Cognitive Theory of Multimedia Learning (Mayer, 2001) and to

provide a simulated model and a mastery experience that can enhance self-efficacy as explained by Bandura (1997b). The AR app enhances a case study with video showing animated characters talking and using body language as they handle ethical dilemmas. These characteristics provide media richness. This rich media could provide experience that enhanced clear messages for learners to understand in a timely manner: they could gain experience by seeing role models of successful leaders and develop self-efficacy.

Use of AR to Support Learning

Technology can help preservice educational leaders to learn ethical dilemmas by providing rich media simulative learning experience and guidance to make decisions. Educators and administrators aim to use cutting-edge technology to promote learning and overcome constraints. Emerging technology has been applied in the field of education to support learning activities and promote necessary skills from lower-order thinking up to higher levels of thinking processes (Almasseri & Alhojailan, 2019; Lightle, 2011; Skiba, 2013). Teachers have used technology in classroom settings to enhance students' understanding and apply what they have learned in simulations into the real world (Cai, Goei, & Trooster, 2016; Hsu et al., 2017; Lu & Liu, 2015). Technology has exposed learners to meaningful learning experience (Celina & Lisbete Madsen, 2011; Nel, 2017; Van Daele, Frijns, & Lievens, 2017).

Benefits of Mobile Technology

Mobile technologies have transformed the way people live by changing the structure of their lives, their processes, and their organizations. For example, people used to bring their laptops to classrooms. However, now the majority of people generally own smartphones and prefer carrying them instead of bringing their laptops (Schwahn & Spady, 2010). In 2019, 96% of Americans owned individual cell phones of some kind (Pew Research Center, 2019). Ninety-one percent of college graduate students in the United States own smartphones (Pew Research Center,

2019). A report showed that 82% of students use their smartphones for individual learning (University of Central Florida's Center for Distributed Learning, 2018). For example, students use smartphones to take notes in class, access discussion board, and view multimedia materials (Rodriguez, Nguyen-Huynh, Fernandez, Royal, & Fernandez, 2014). Technology has become an essential role in enhancing student learning, especially since the different types of technology have been developed to be more efficient and affordable (Raghunath, Anker, & Nortcliffe, 2018).

Technology to Scaffold Learning to Face Ethical Dilemmas

Technology has the ability to provide multimedia content that can enhance learning from case studies. For example, technology enables students to learn case studies from case-based videos, websites, texts, and graphics (Saltan et al., 2016). Through this technology, case studies can offer learners situations that will help them in facing legal challenges while diminishing legal exposure. This simulative experience happens in a safe practice setting. Providing these practices will allow educational leaders to exercise responsibility. Augmented Reality is technology that enables users to see multimedia case studies and information over a real-world setting. For example, users can see physical case-based worksheets and also interact with case-based videos on a mobile screen over the same worksheets. The unique aspect of AR helps teachers scaffold lessons through multimedia content.

Overview of Augmented Reality

Augmented Reality is a mobile technology that has been designed and developed to enable students to access nearby learning content on smart devices. Students can experience a virtual learning environment in the real world. AR has been used in various fields such as medical, entertainment, military, engineering, path planning, and visualization (Azuma, 1997).

Definitions of Augmented Reality

Augmented Reality (AR) is an emerging technology that "allows the user to see the real world, with virtual objects superimposed upon or composited with the real world" (Azuma, 1997, p. 2). Augmented Reality enables users to see and interact with virtual objects on mobile display screens which augment a real-world atmosphere. AR allows users to access knowledge content at anytime and anywhere. AR provides interactive, multimedia instructions that students can quickly use to access knowledge content. For example, the Meteo AR application enables users to learn about the earth with an augmented reality interface. Learners can use a smartphone or tablet's camera to trigger an image on one of the downloadable "science sheets." Afterwards, the 3D earth graphic and information will be displayed. Users can interact with the content and rotate the globe. AR has been implemented in educational activities because it is affordable and establishes high effectiveness for learning (Liu, Dede, Huang, & Richards, 2017).

AR is an alteration of virtual environments known as virtual reality. Virtual environment technologies offer users immersive synthetic environments where they cannot see the real world surrounding them. However, AR enables users to see both the real world and virtual objects augmented on the real world. Therefore, users can see the real and virtual objects coexisting in the same place (Azuma, 1997). Azuma (1997) defines AR as a system that has the three main characteristics: (1) it combines real and virtual objects, (2) it is interactive in real time, and (3) it is registered in 3D (p. 2).. The ability of AR to combine real and virtual objects enhances users' perspectives of the real world and enables them to interact with it. The virtual objects that display on AR can guide users to perform real-world tasks. VR aims to create a whole virtual space, while AR combines reality and virtual reality (Azuma, 1997; Garzón, Pavón, & Baldiris, 2019).

AR is a significant technology that combines reality with digital content. People from various sectors such as researchers, teachers, engineers, and practitioners are applying AR technology to benefit users in their field. Teachers implement AR to enrich teaching and learning experiences (Bacca, Baldiris, Fabregat, Graf, & Kinshuk, 2014; Cabero-Almenara, Barroso-

Osuna, Llorente-Cejudo, & Martínez, 2019; Garzón et al., 2019). AR is categorized into various types such as AR headset mounted devices (HMD), AR games, AR peripherals, AR applications, AR services, AR marketing, and AR distribution. The trend of AR has experienced an accelerated growth due to the improvement of mobile technology (Papanastasiou et al., 2019).

AR Features

As Azuma (1997) describes, the main features of AR are combining real and virtual content that is interactive in real time and is registered in 3D. AR adds virtual information to the real world's existing environment. Users can see both real-time computer-generated digital content and the real world (Salmi, Thuneberg, & Vainikainen, 2017). Since AR embeds digital content within the physical environment, it can provide more immersive learning environments for students to interact with than other technologies (Cai, Liu, Yang, & Liang, 2019). AR can include graphics, audios, videos, 3D models, and schemes (Cai et al., 2019). In addition, AR can be used as AR physical books that are matched with an AR application on a mobile device (Green et al., 2019). The reader can download the application on a personal device, open the app, and scan the book's markers (such as AR trigger image) to activate the AR experience in real time. The user can interact with 3D objects, and zoom in and out to see objects from different angles.

Additionally, AR in education provides real time feedback and learning outcomes (Bacca et al., 2014). AR provides interactive controls, computer graphics, and image recognition. These technologies can be implemented in learning and provide interactive learning environments for students. Learning simulations can have positive impacts on students' attitudes and learning (Lu & Liu, 2015). The interactive, intuitive, and efficient experiences can provide new opportunities for students to develop skills (Sirakaya & Cakmak, 2018).

Use of AR in Education

AR has been used in education to design pedagogical materials to enrich technology and learning experiences (Garzón et al., 2019). Research has shown that AR promotes students' self-efficacy (Cai et al., 2019; Lu & Liu, 2015; Sirakaya & Cakmak, 2018), motivation (Bacca et al.,

2014; Hsu et al., 2017; Salmi et al., 2017; Taskiran, 2019), and academic achievement (Myran & Sutherland, 2016; Vallera, 2019). The literature is discussed in detail below.

1) Use of AR to Promote Self-Efficacy.

Self-efficacy refers to "a person's estimate that a given behavior will lead to certain outcomes" (Bandura, 1977, p. 193). According to Bandura (1977), the expectations of self-efficacy are acquired from four informational sources including (1) personal accomplishments, (2) vicarious experiences, (3) verbal persuasion, and (4) physiological states. According to Cai et al. (2019), AR was used in a mathematic course to illustrate virtual content that was hard to see in the real world. The researchers found that AR assisted students in learning abstract mathematical concepts. It helped students improve their self-efficacy, pay attention to advanced conceptions, and apply more challenging strategies while learning math. According to Lu and Liu (2015), students in a marine education course had high confidence in learning activities with AR. They received the target knowledge and improved learning performance. In the same fashion, Sirakaya and Cakmak (2018) researched the use of AR in an assembly hardware course by demonstrating how to assemble part of a motherboard. The researchers reported that AR had positive effects on learner achievement on assembling motherboard, but it had no effect on student self-efficacy regarding assembly skills and theoretical knowledge. AR helped students' complete tasks of assembling processes in a short time with less assistance. Research showed that AR provided content or tools may boost learners' confidence to accomplish assigned tasks or learning goals. AR has the potential to support self-efficacy but continuing research is needed to confirm this.

2) Use of AR to Promote Student Motivation.

Research showed that AR increased student motivation (Di Serio, Ibáñez, & Kloos, 2013; Tobar-Muñoz, Baldiris, & Fabregat, 2017; Yang, Mei, & Yue, 2018). The definition of motivation is drawn from Keller (1979), who defines motivation as "that which accounts for the arousal, direction, and sustenance of behavior" (p. 27). Motivation in the educational field is

defined as “the student’s desire to engage in a learning environment” (Di Serio et al., 2013, p. 587). According to Yang et al. (2018), preservice chemistry teachers who used Element 4D, a mobile augmented reality application for chemical education, agreed that an AR applicaion increased interest in learning the subject (Yang et al., 2018). Furthermore, children who used the *Augmented Reality Game-Based Learning* game increased their motivation and interest in the learning activity (Tobar-Muñoz et al., 2017). AR learners also asserted that AR learning systems made learning simple and enjoyable. They expressed, “Nice, it is so easy!...I find that it is really easy to use…It is just like a game” (Di Serio et al., 2013, p. 591).

Additionally, Taskiran (2019) discovered that AR motivated students to learn and provided enjoyable learning environment in an English as foreign language classroom. According to Salmi et al. (2017), AR increased student motivation and attitude toward their learnings in a science education course among boys than girls. Furthermore, Hsu et al. (2017) reported that students had positive perspectives of AR simulations and instructions. Students had high motivation and engagement in STEM interests. AR provided hands-on learning, practical skills, and immersive learning environment of medical surgical procedures.

3) Use of AR to Provide Rich Media Case Studies.

AR has the capability to provide rich media case studies and enhance storytelling. Storytelling is a learning tool that engages students to learn and make meaning from the messages. It can help students understand abstract ideas and connect them with meaningful concepts (Vallera, 2019). Digital story telling applies technologies such as video, graphics, and audios, to deliver information (Vallera, 2019). It can encourage learners to think critically and creatively (Vallera, 2019). AR has the ability to provide situations where learners can be immersed in their studying through the virtual experience in the content. Vallera (2019) created an AR textbook that triggered videos about the theoretical paradigms in sociological theories. The results showed that students in the treatment group had higher scores and gained more

understanding than the control group. They increased motivation, interest, and enjoyment in learning the topic. Vallera (2019) suggested use of AR applications to create case studies so that students are engaged with and virtually immersed in their learning.

Additionally, implementing AR in case studies and hands-on learning activities can develop students' practical skills (Hsu et al., 2017). According to Hsu et al. (2017), embedding AR in rich media case scenarios in medical surgical procedures promoted students' motivation and engagement in improving practical skills on medical surgery as well as inspired them to choose STEM-relevant majors in higher education. The researcher asserted that spatial visualization in AR helped reduce cognitive load while students engaged in STEM-related activities. In the same way, Green et al. (2019) asserted that problem-solving scenarios that were embedded in AR books made the reader become immersed in the case environment. The reader could interact with the provided experiences such as tapping the image of a tiny child in the story to see the child roll or jump on the floor. This gave an opportunity for the reader to enter into the virtual story.

There is currently very little published scholarly literature on the use of the Zappar application for educational purposes. In one study by Naese et al. (2019), it was used for exploring digital archives in a fashion design project called the *FITting Room*. From a prototype, Zappar enables users to try on a dress, hat, or make-up from history. It allows users to see their face on a selfie smartphone camera and select a piece of a fashion sketch available on the application to wear over their face or body (Naese et al., 2019). In another study, educators used Zappar, utilizing Zap codes, to show rich content of video demonstrations on a poster in a secondary mathematics course and K-3 afterschool club. The contents are about a road trip from Iowa to Mexico and exploring the life cycle of the caterpillar (Nadolny, 2017). The findings showed that students had fun experience in the AR learning activities (Naese et al., 2019), and Zappar engaged students to interact with the digital learning content by offering an immersive

design page, focused task, immediate feedback, and high level cognitive exercises. (Nadolny, 2017).

Review of Methodological Literature Relevant to the Study

From the review of methodological literature relevant to the study, Gilbert et al. (2018) have a convergent parallel mixed-methods research that provided a model for the current study. Gilbert et al. (2018) investigated how simulative learning environments enhance educational leaders' self-efficacy in the professional learning community program. Gilbert et al. (2018)'s study is similar to the current study because both studies use the same convergent parallel mixed-methods design. This type of study is appropriate for the current research questions because it can address whether augmented reality promotes perceptions of self-efficacy in learning, and how educational leadership students perceive the AR lessons. Additionally, qualitative data from the interviews can expand on the reason why AR either increases or decreases students' self-efficacy in learning educational ethics and law. However, the topic of the current study is different than Gilbert et al. (2018)'s study. This study focuses on learning to face ethical dilemmas, while Gilbert et al. (2018)'s study focuses on professional development training among educational leaders.

Synthesis of Research Findings

The research studies evaluated here show that AR has been introduced in the educational field, and its benefits have been explored. For example, it helps educators deliver multimedia instructional materials that learners can interact with. Research showed that AR increased learning motivation (Bacca et al., 2014; Cabero-Almenara et al., 2019; Cai et al., 2019; Garzón et al., 2019; Hsu et al., 2017; Salmi et al., 2017; Taskiran, 2019), promoted authentic case studies (Green et al., 2019; Hsu et al., 2017; Papanastasiou et al., 2019; Vallera, 2019) , and increased self-efficacy (Lu & Liu, 2015; Sirakaya & Cakmak, 2018; Vallera, 2019) in learning skills.

However, no research has explored users' self-efficacy toward the use of AR in learning and solving ethical dilemmas. Based on the literature review search, I used databases including ERIC (Education Resources Information Center), ProQuest, and Scopus. The search terms were "augmented reality," "self-efficacy," and "ethical dilemma*". The search result showed that no research about the impact of using augmented reality in promoting self-efficacy while learning ethical dilemmas had been published. The current study therefore explored whether AR learning materials would increase educational leaders' self-efficacy in learning educational ethics/law.

Critique of Previous Research

The previous review includes qualitative, quantitative, and mixed method research about student self-efficacy, motivation, and academic achievement through learning with AR instructional materials. Although technology-enhanced learning methods have been introduced in the classroom, researchers are still exploring their benefits and implications (Di Serio et al., 2013; Tobar-Muñoz et al., 2017; Turan, Meral, & Sahin, 2018; Yang et al., 2018). Previous literature has contributed by showing that technology like AR can scaffold learning to face ethical dilemmas by incorporating multimedia learning materials. Learning with multimedia enables students to receive information from multiple formats such as text images and sounds, which helps students understand the lesson deeply (Mayer, 2001). Additionally, AR allows students to see the superimposed digital content over printed learning materials (Sommerauer & Müller, 2014). Students can see rich media case scenarios from videos and interact with the lesson to explore possible consequences when they deal with ethical dilemmas. AR can enhance learning by increasing student self-efficacy when they see the appropriate role models or sample solutions that guide them to make decisions. The current study fills a gap in the existing literature by exploring the use of AR in promoting preservice educational leaders' self-efficacy in learning to face ethical dilemmas.

Summary

This literature review focuses on the use of AR in enhancing educational leaders' self-efficacy in decision making regarding educational ethics/law. The review is divided into five parts including (1) ethical dilemmas in the workplace (2) the use of case studies to help novices learn how to face difficult workplace situations, (3) self-efficacy, (4) a cognitive theory of multimedia learning, and (5) the use of AR to support learning. Most research agreed that case studies help facilitate teaching students to prepare for real life situations that they will face in their future professions (Bignell, 1999; Buffington & Harper, 2002; Grimes, 2019; Strangeways & Papatraianou, 2016). In order to promote rich case studies, technology has become a tool to aid students so that they can learn through multimedia. AR technology has been implemented to engage students in learning a topic since its ability to overlay virtual content over physical objects or printed text materials (Azuma et al., 2001). Research demonstrated that AR promoted rich media case scenarios that students could learn from videos and interact with digital content on AR mobile applications (Green et al., 2019; Hsu et al., 2017; Papanastasiou et al., 2019; Vallera, 2019). Although AR has been increasingly implemented in the field of education in recent years (Bacca et al., 2014), research on using AR to promote educational leadership students' self-efficacy in learning to face ethical dilemmas has not been investigated. Therefore, The researcher investigated whether or not AR could assist preservice educational leaders' self-efficacy in learning to face ethical dilemmas, and how well it aided in learning the topic. The self-efficacy theory and cognitive theory of multimedia learning were used as theoretical framework to guide this study. The next chapter explains methods of collecting and analyzing data.

CHAPTER III

METHODOLOGY

The purpose of this study was to explore the ways in which AR learning materials enhanced preservice educational leaders' self-efficacy in learning to face ethical dilemmas. The AR application in this study aimed to provide case studies with rich multimedia that preservice educational leaders could learn from. In the *Leadership Theory and Ethical Decision Making* and *School Leadership, Culture and Ethics* classes, preservice educational leaders used their mobile device to scan an AR code on the PDF case study worksheet. Afterwards, they viewed the multimedia case scenario, chose a decision offered, and explored possible consequences of their decision making on the AR application. A mixed-methods research design was used to investigate the self-efficacy impact on preservice educational leaders that AR could have on learning educational ethics. In addition, the perceived self-efficacy levels with solving the ethical dilemma were analyzed. The research questions guiding this study were the following:

1. What is the influence of an AR application, that provides rich media problem-solving experiences, on preservice educational leaders' self-efficacy for addressing ethical dilemmas?
2. How do preservice educational leaders perceive the AR lessons and their effects on self-efficacy?
3. To what extent do the quantitative results on self-efficacy agree with the interview findings on preservice educational leaders' experiences with the AR app?

Research Design

A *mixed-methods design* was used with quantitative data through pre-/post- surveys and supported by qualitative data through interviews (Creswell & Plano Clarke, 2018). The convergent parallel design method was selected in this mixed-methods research because it produced triangulation of findings by comparing quantitative results with qualitative findings to gain a more thorough understanding of the research questions. The researcher collected and analyzed quantitative and qualitative data separately, then merged both data for comparing or combining the results. This convergent design brought strengths and weaknesses of both quantitative and qualitative methods. In other words, it combined generalization, trends, and objective measures, with details, depth, and subjective interpretation (Creswell & Plano Clarke, 2018).

The strength of this design is its effectiveness in collecting both datasets in one phase at about the same time. Each set of quantitative and qualitative data can be collected and analyzed independently and separately. Researchers can report statistical trends and express participants' thoughts through both quantitative and qualitative data collection. Even though this design is popular in mixed-methods research, it is challenging to use different sample sizes when merging two datasets. In addition, it is challenging to merge numeric data with text data. The researcher has to explain more when comparing results. It can be hard for the researcher to explain if the results are different (Creswell & Plano Clarke, 2018). Nevertheless, the researcher chose this design as the best way to answer the research questions because it could address the influence of AR on preservice educational leaders' self-efficacy and their perspectives in using the AR lesson. The research could investigate how both quantitative results and qualitative findings supported or differed from each other.

Quantitative data was collected using a questionnaire that combined and adapted several previously published instruments. The *School Administrator Efficacy Scale (SAES)* (McCollum & Kajs, 2009) and the *self-efficacy survey* (Gilbert et al., 2018) were to investigate the participants'

self-efficacy while learning from the AR-enhanced case study. Additionally, the *technology self-efficacy survey* Zhang et al. (2017) and the *task self-efficacy survey* (Holden & Rada, 2011) were adapted and asked participants how well technology assisted them to learn the activity. A follow-up interview method was used to collect qualitative data to complement the quantitative survey data.

Data for this research was collected and analyzed through the perspectives of the Self-efficacy theory (Bandura, 1977) and the cognitive theory of multimedia learning (Mayer, 2001). Data was collected with the following research instruments:

1. Demographic questionnaire.
2. The School Administrator Efficacy Scale (SAES) developed by McCollum and Kajs (2009). Databased Decision Making Aligned with Legal and Ethical Principles questionnaire was selected.
3. The self-efficacy survey developed by Gilbert et al. (2018).
4. The technology self-efficacy and response-efficacy surveys developed by Zhang et al. (2017).
5. The task self-efficacy survey developed by Holden and Rada (2011).

Context for the Study

In this study, participating preservice educational leaders learned about solving ethical dilemmas through the case study enhanced with an Augmented Reality (AR) application. They used the AR application to scan a case scenario on a PDF worksheet. Afterwards, the multimedia simulations regarding ethical dilemmas displayed and demonstrated a case scenario for participating preservice educational leaders to view. After learning a specific scenario, a preservice educational leader chose a potential decision and saw a consequence of his or her decision making. Preservice educational leaders practiced solving ethical dilemmas and saw the consequences of their decisions regarding educational ethics. The requirement for the preservice

educational leaders was to have a mobile device, such as a tablet or a smartphone, that had an installed AR application and a camera that could scan an AR code on a worksheet. Then, the multimedia instruction popped up and guided them to learn knowledge content. Preservice educational leaders would encounter simulative learning experiences on the AR application through a case scenario regarding the ethical dilemma.

Participants

Participants were master's and doctoral students in the educational leadership program who were enrolled in the *Leadership Theory and Ethical Decision Making* class and *School Leadership, Culture and Ethics* courses at a very high research university in the South-Central region of the United States. The 17 participants were drawn from both male and female populations regardless of age and ethnicity. Participants were over the age of 18, and they were not required to have prior experience using AR applications. Although all students enrolled in the courses would have the opportunity to use the AR application as part of their class activities, participation in the research was voluntary. Participants in the qualitative portion of the study were drawn from the quantitative research population. After quantitative participants completed the survey, they were asked if they were willing to be interviewed and participate in the qualitative phase. Fourteen participants from quantitative research participated in qualitative research.

Process for Designing the AR Lesson

The process of designing the AR lesson included: (1) planning the ethical dilemma lesson, (2) creating the AR worksheet, (3) creating case study videos, and (4) creating an AR experience.

1. Planning the Ethical Dilemma Lesson

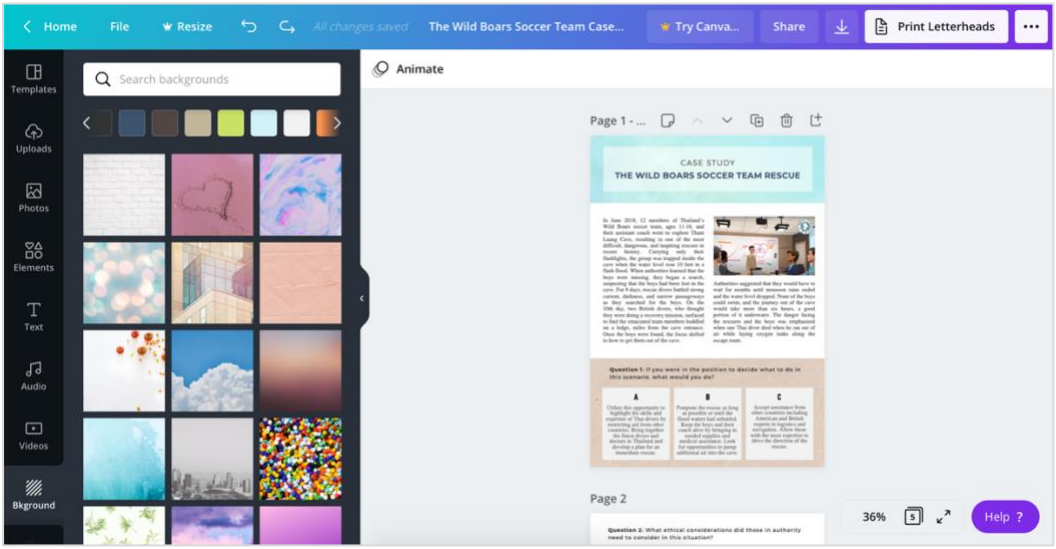
The ethical dilemma lesson was planned by the course instructor. The researcher and course instructor first discussed a case scenario that preservice educational leaders could learn from. The course instructor selected the ethical dilemmas case scenario and provided discussion questions. The scripts for the case studies were written as shown in Appendix I. Afterward, the researcher designed the AR lesson by creating a worksheet on Canva, making animated case study videos on Plotagon, and creating an AR experience on ZapWorks Studio. The suitability of the design was checked in a pilot study. Participants in a pilot study took the AR application usability test survey in order to validate that the AR learning application was usable and appropriate to use in class.

2. Creating the Worksheet on Canva

The AR lesson worksheet was created through Canva as in Figure 3.1. Canva is an online website that provides users with professional layouts, graphics, and drag-and-drop features to create designs (Canva, 2021). Canva was selected because it was free and provided simple drag-and-drop features for inserting texts, photos, backgrounds, and other media elements. In this study, Canva was used to create a two-page PDF worksheet that presented a text-based case study scenario regarding the ethical dilemma lesson, three possible choices of decision-making, and discussion questions. The worksheet also included a screenshot of the animated case study video and a Zapcode embedded from Zappar studio. This Zapcode allowed participants to scan and enable the AR experience through Zappar application over the worksheet.

Figure 3.1

Screenshot of Canva working space



The researcher selected a worksheet template. Then, the researcher added the case study content by clicking the “Text” button on the left side menu and typed the topic, case study content, a question, and answers. The researcher uploaded a case study image by clicking on the “Uploads” button on the left side menu and uploaded the image. The researcher inserted the image to the handout and added a background. The product was downloaded as a PDF worksheet as shown in Figures 3.2 and 3.3.

Figure 3.2

A screenshot of AR case scenario exercise (page 1)

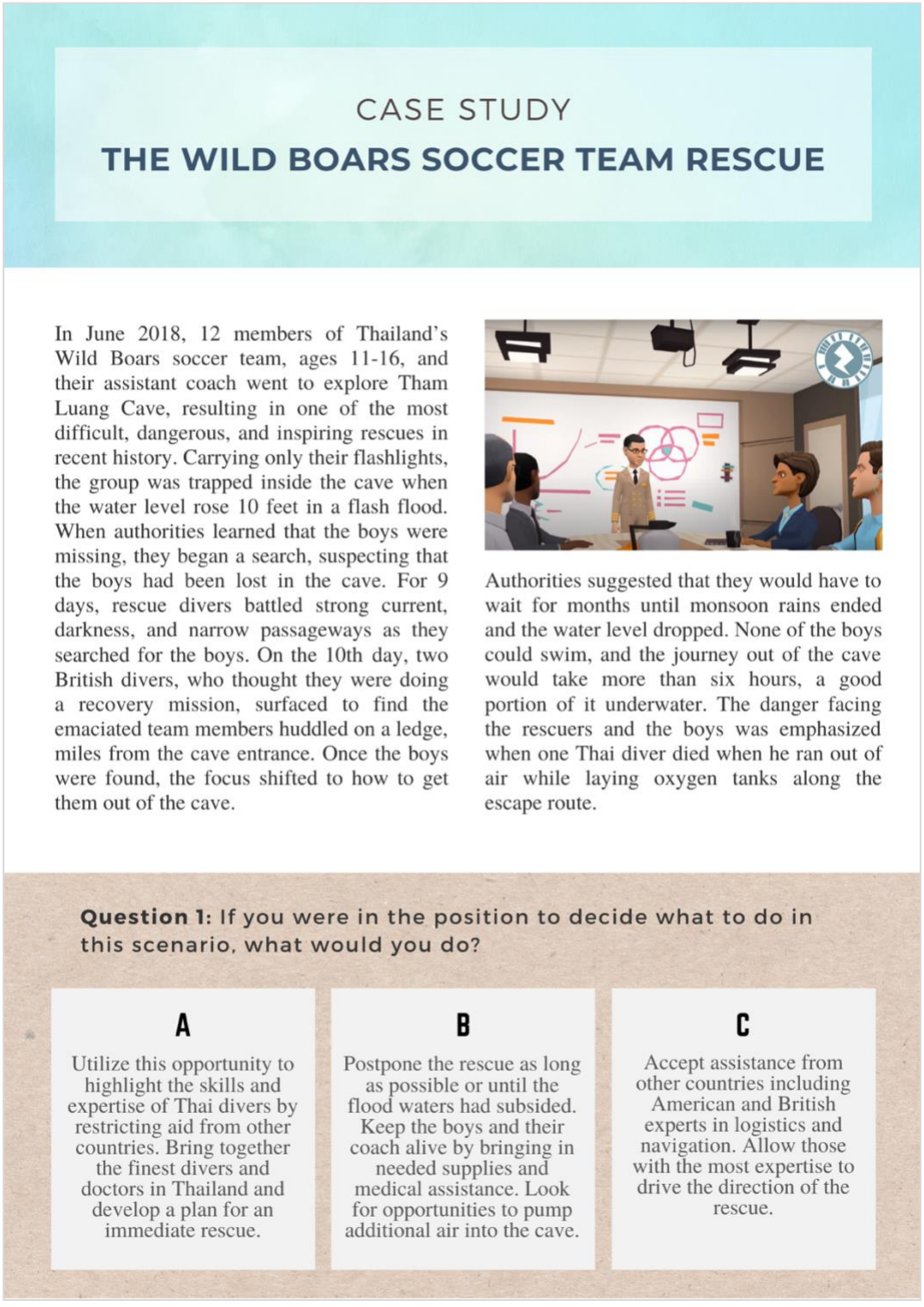
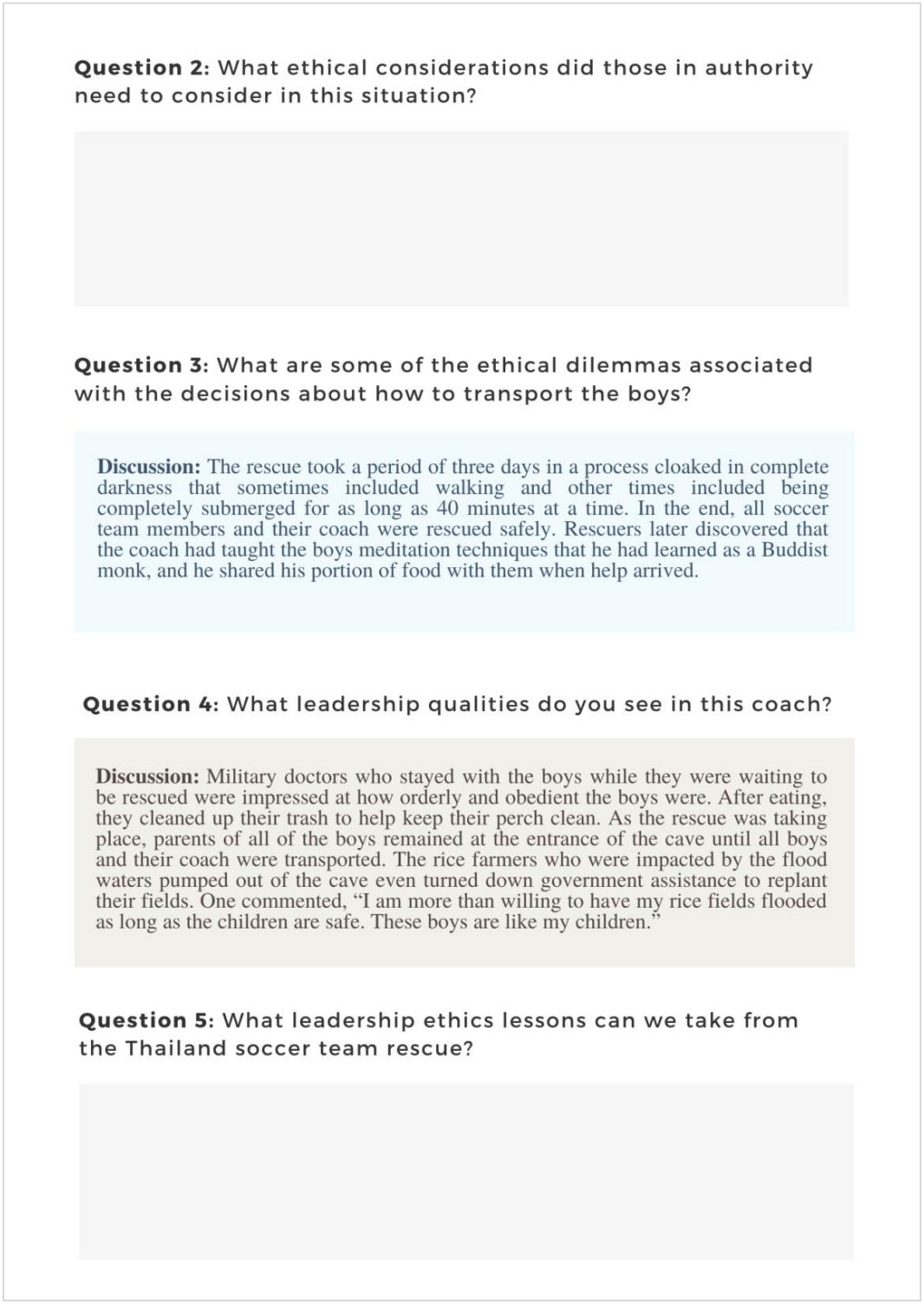


Figure 3.3

A screenshot of AR case scenario exercise (page 2)



3. Creating Case Study Videos on the Plotagon Application

The animated case study videos were created on the Plotagon application as in Figure 3.4. Plotagon is an application for creating animated storytelling. It provides an animation studio that allows creators to select scenes, create actors, write stories, record voice over, add sound effects or music, and make animated movies (Plotagon, 2021). In this study, Plotagon was used to create animated case study videos according to the ethical dilemma lesson. These videos included one main case study and three consequence videos. The videos included animated characters, transcriptions, voice over, background music, and sound effects.

The researcher created each case study video by selecting a theme where its environment matched with the situation. For example, in the following sample (Figure 3.5), the scenario was in a conference room where the leadership team conducted a meeting and discussed the situation. The researcher created characters such as a head authority and other authorities by designing each avatar with different outfits, voices, and physical characteristics (Figure 3.4). Afterwards, the researcher selected characters appropriate for the scenario and added conversations, background music, and sound effects. Once one scenario was completed, the researcher could add other scenarios to make a story. Then, the researcher exported the case study video and imported it into Zap Works Studio.

Figure 3.4

A screenshot of an avatar created on the Plotagon application

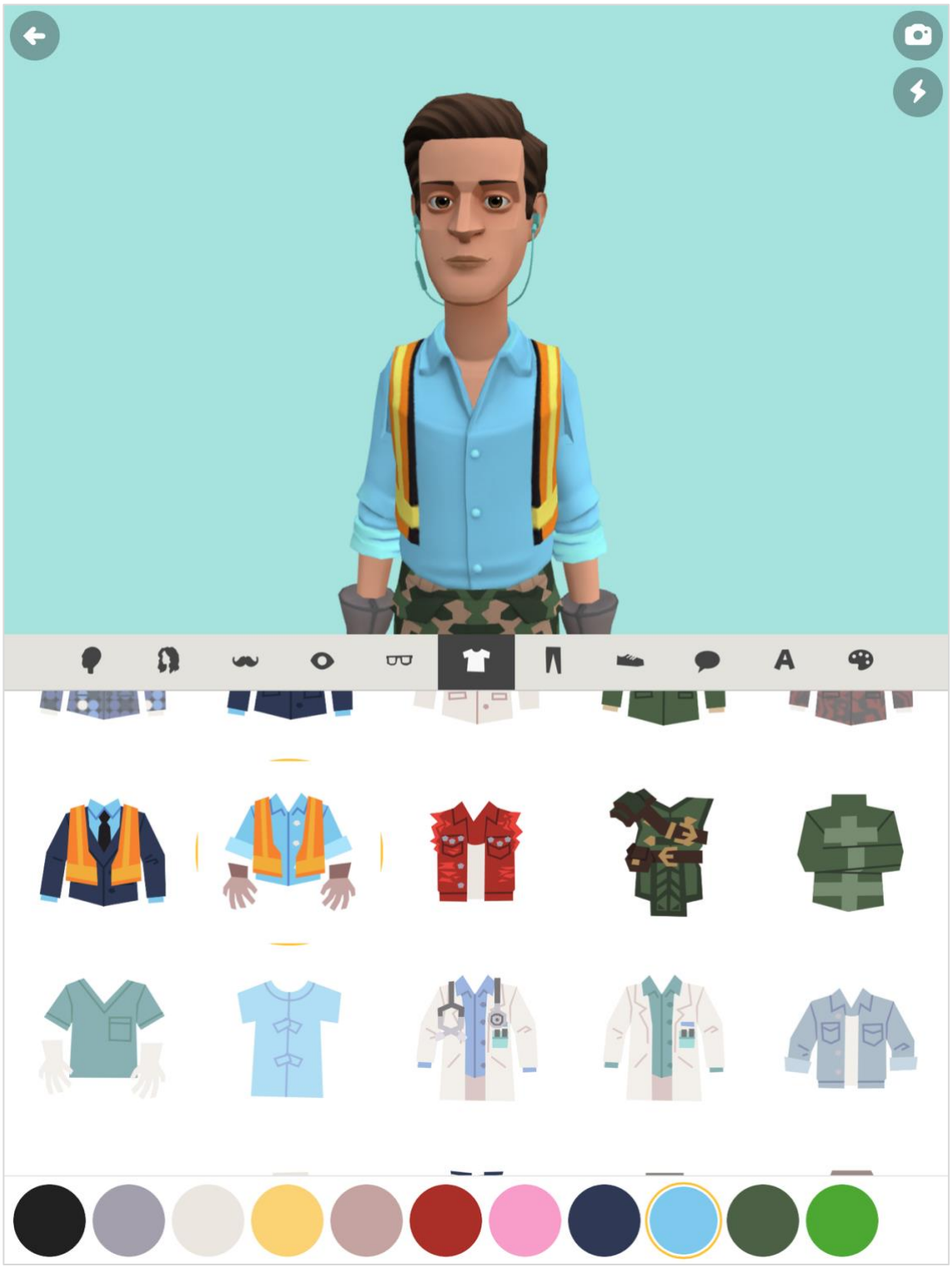
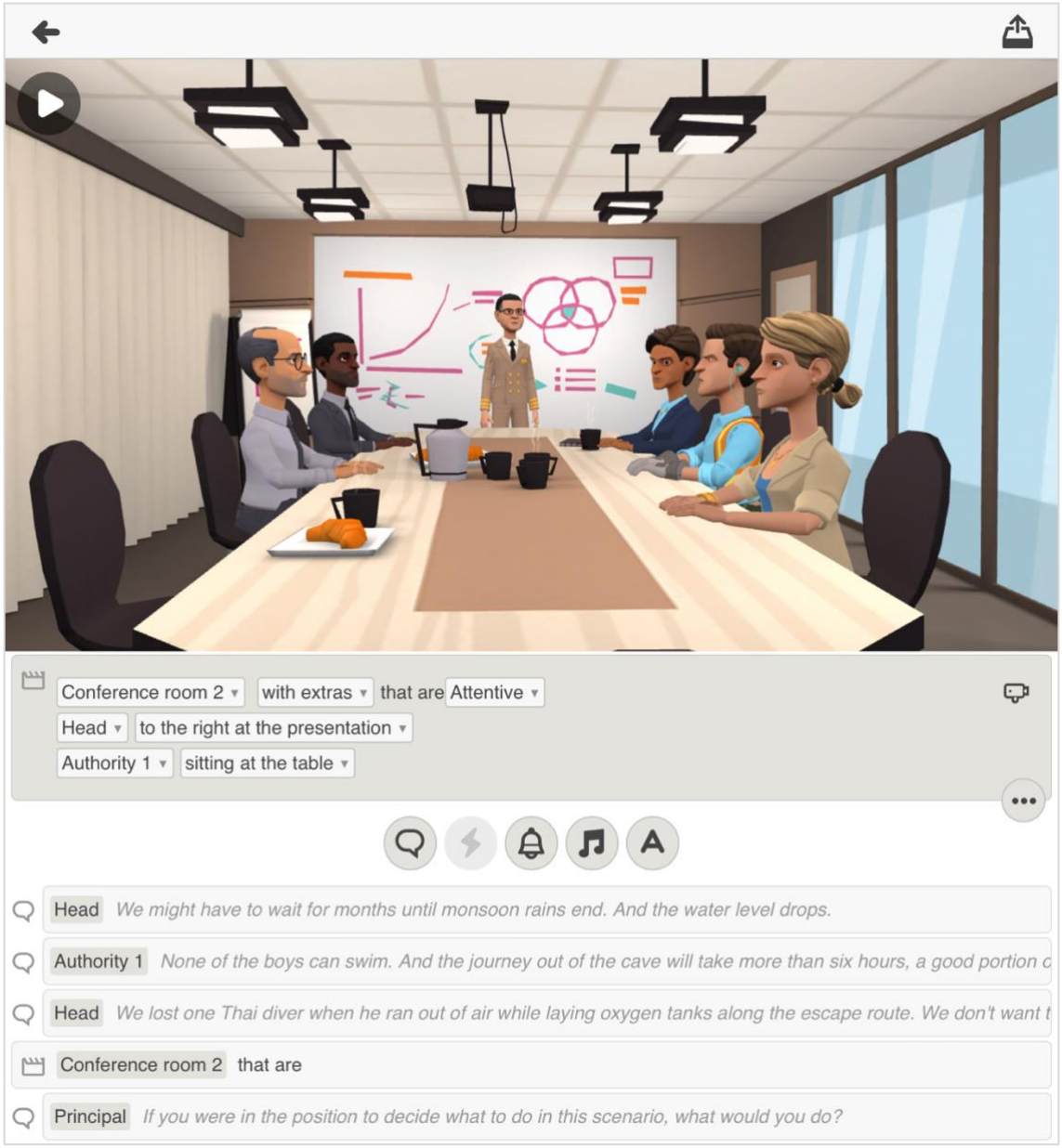


Figure 3.5

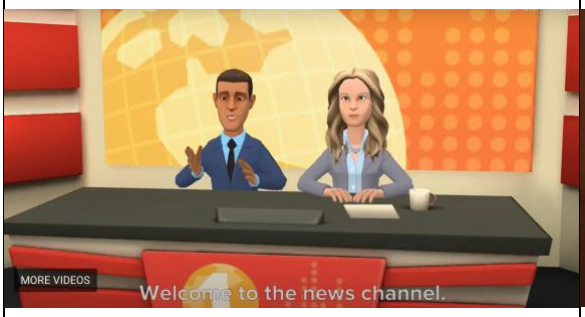
A screenshot of the case study created on the Plotagon application



The products of the case study videos were illustrated in Figure 3.6. The videos included one main case scenario and three consequence videos.

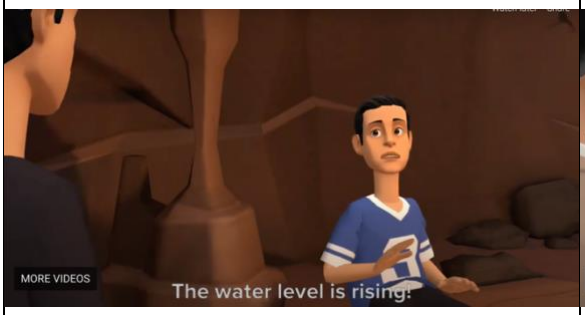
Figure 3.6

Screenshots of animated case study videos created from Plotagon



Case scenario video (2:00 minutes)

Consequence A video (0:29 minutes)



Consequence B video (0:13 minutes)

Consequence C video (1:12 minutes)

4. Created an AR Experience on ZapWorks Studio

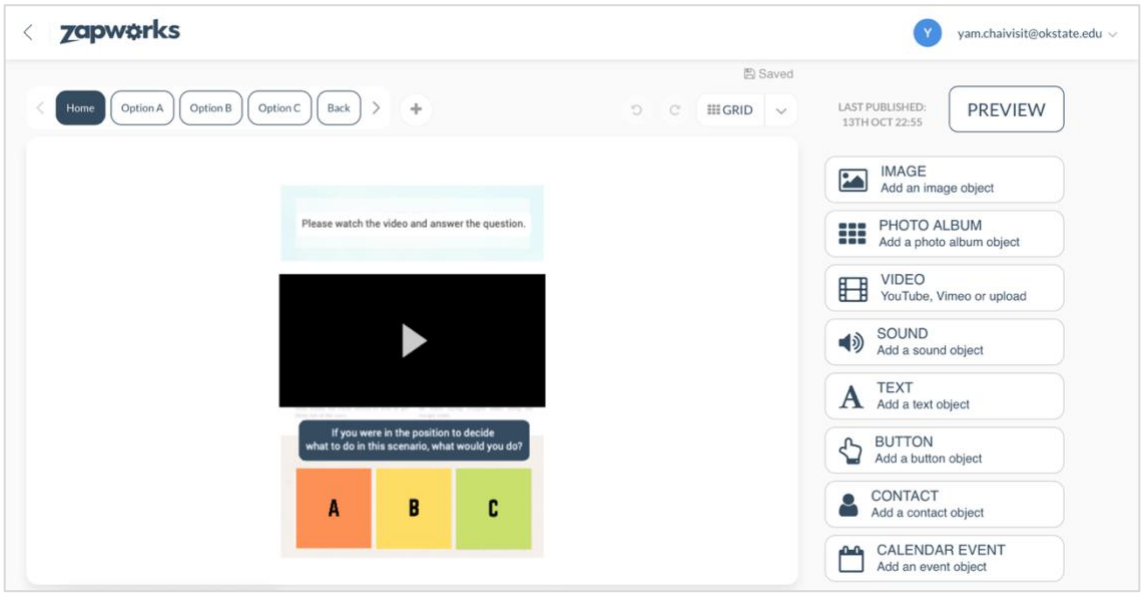
The AR digital content was developed through ZapWorks Studio, which is an augmented reality platform that allows developers to create AR and Mixed Reality experiences through a creative studio (Zappar, 2020). Developers can create AR experiences through three platforms including widget, designer, and studio. ZapWorks Studio allows developers to distribute interactive content such as videos, pictures, animations, and social media shares on a mobile application called Zappar. AR Users have to download the Zappar mobile application in order to engage with AR environments. Once users have the application installed, they can scan a

Zapcode on the product or object that they wish to learn about. Then, the interactive media will pop up on the users' mobile screen. Users can interact with the multimedia content and engage in learning.

In this study, ZapWorks Studio was used to create AR experience by including the case study videos, interactive questions and answers, and a Zapcode which was embedded on the worksheet. ZapWorks Studio was selected because it was free for users and worked on both Android and iOS devices. ZapWorks Studio has been widely used in education because of its easy drag-and-drop functions allowing educators to easily create digital content. It offered immersive learning experiences for students to explore a topic through videos, audios, photos, etc.

Figure 3.7

A screenshot of ZapWorks Studio work space

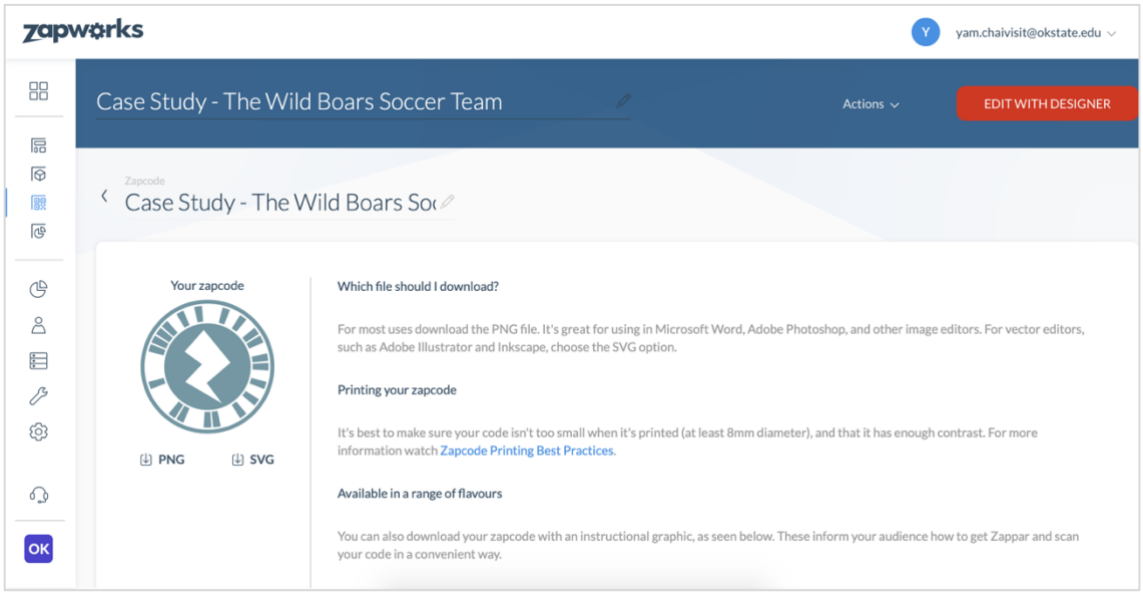


The researcher first uploaded a tracking case study handout image into the work space. Then, the researcher clicked on the "VIDEO" button to upload a case study video, the "TEXT" button to type a case study question, and the "IMAGE" button to add choice A, B, and C images. In order to link each choice button to its consequence video page, the researcher created four

more pages by clicking on the "+" button on the top of the page and set choices to link to Option A, Option B, Option C, and Back pages. In each page, the developer inserted a consequence video, a short description text, and a "BACK" button for clicking back to the Home page. Once the content was ready, the researcher generated the Zapcode and embedded it in the worksheet on Canva.

Figure 3.8

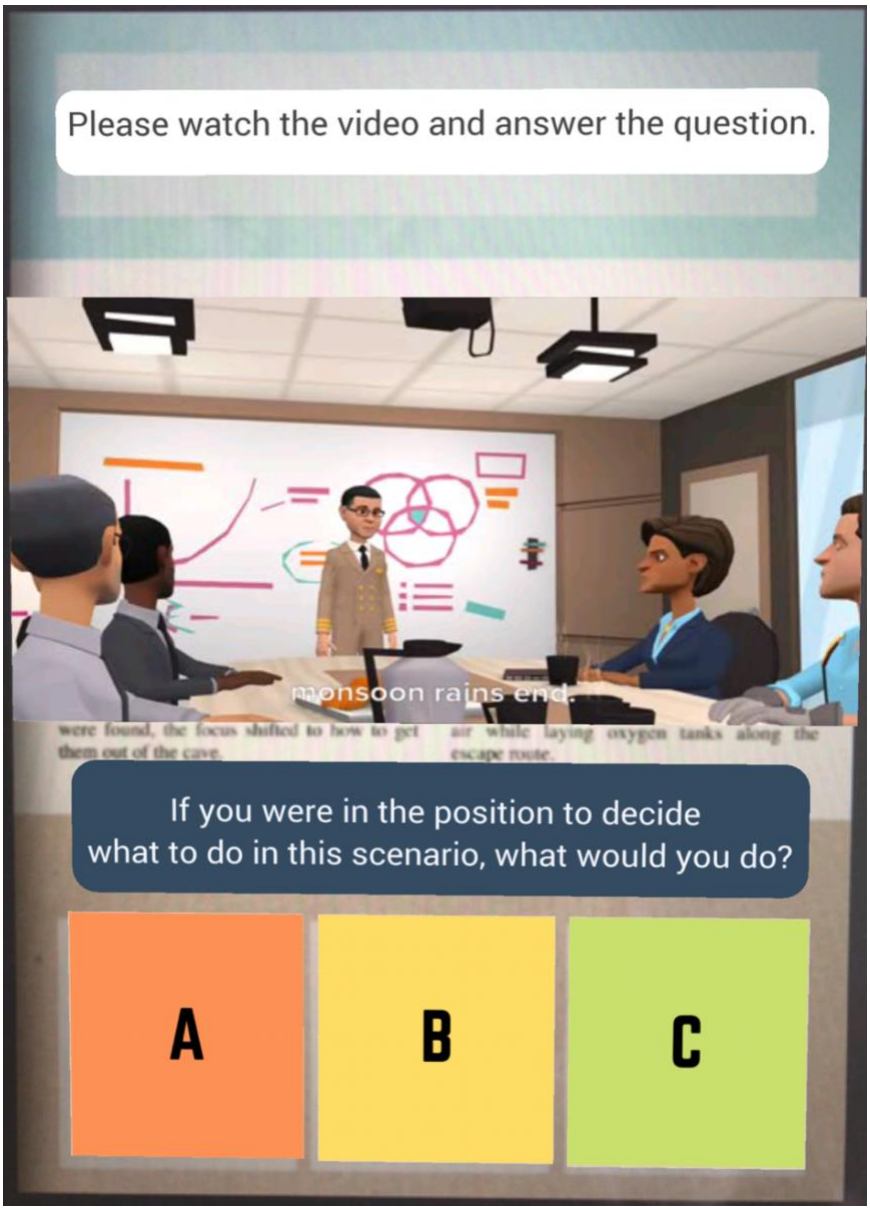
A screenshot of Zapcode generator



Participants could use their mobile Zappar application to scan the Zapcode on the worksheet. Afterward, the AR content would appear on the application screen. The product of the AR lesson on a mobile device was illustrated in Figure 3.9.

Figure 3.9

A screenshot of the AR interface on Zappar application



Once the participant scanned the content, they would see the case video and choice buttons overlaid on the PDF worksheet. The video at the middle of the content was the case scenario showing the context of the story. After the participant watched the case-based video on the AR application, they would think about the solution and select one of the three options. Then,

a possible consequence of the decision making that the participant selected would pop up as in Figures 3.10 to 3.12. The participant could interact with choices and explore other consequences.

Figure 3.10

A screenshot of Consequence A page

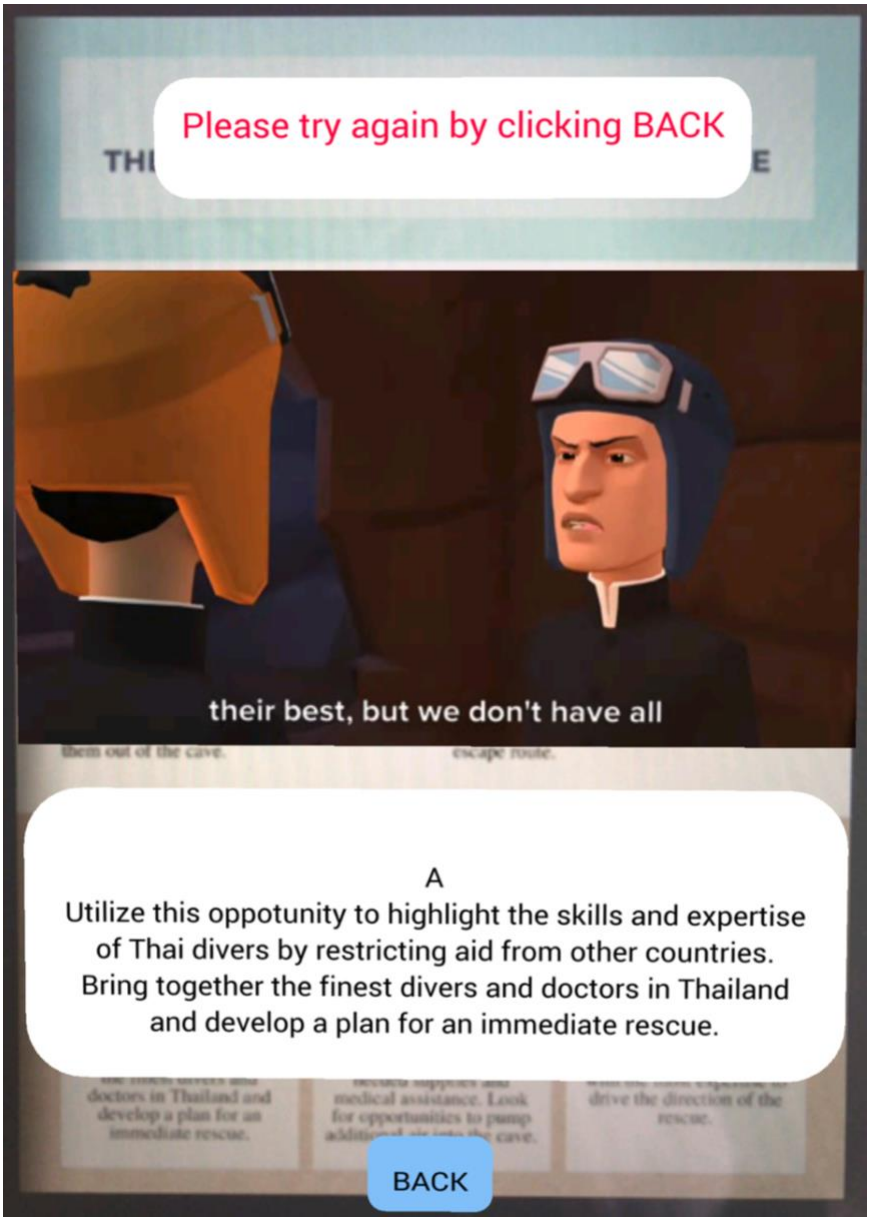


Figure 3.11

A screenshot of Consequence B page

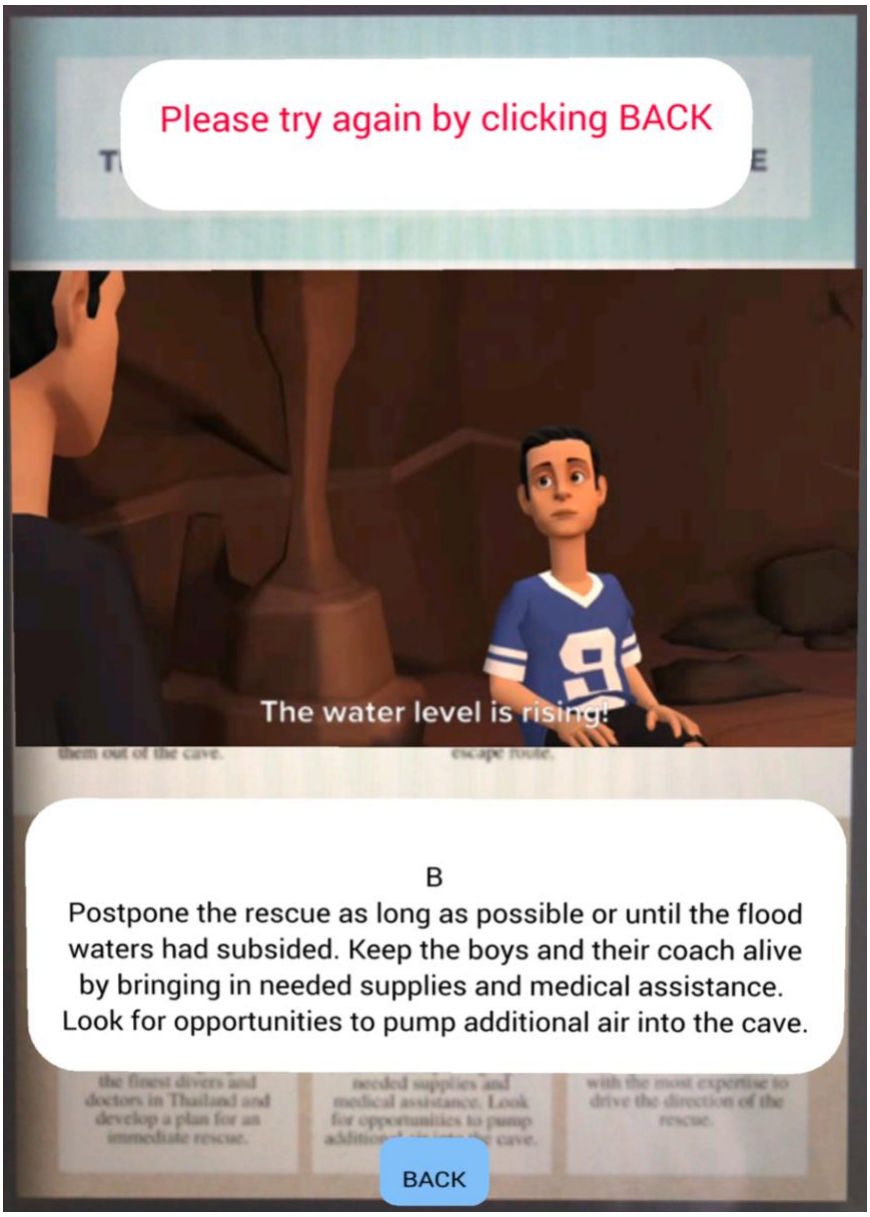
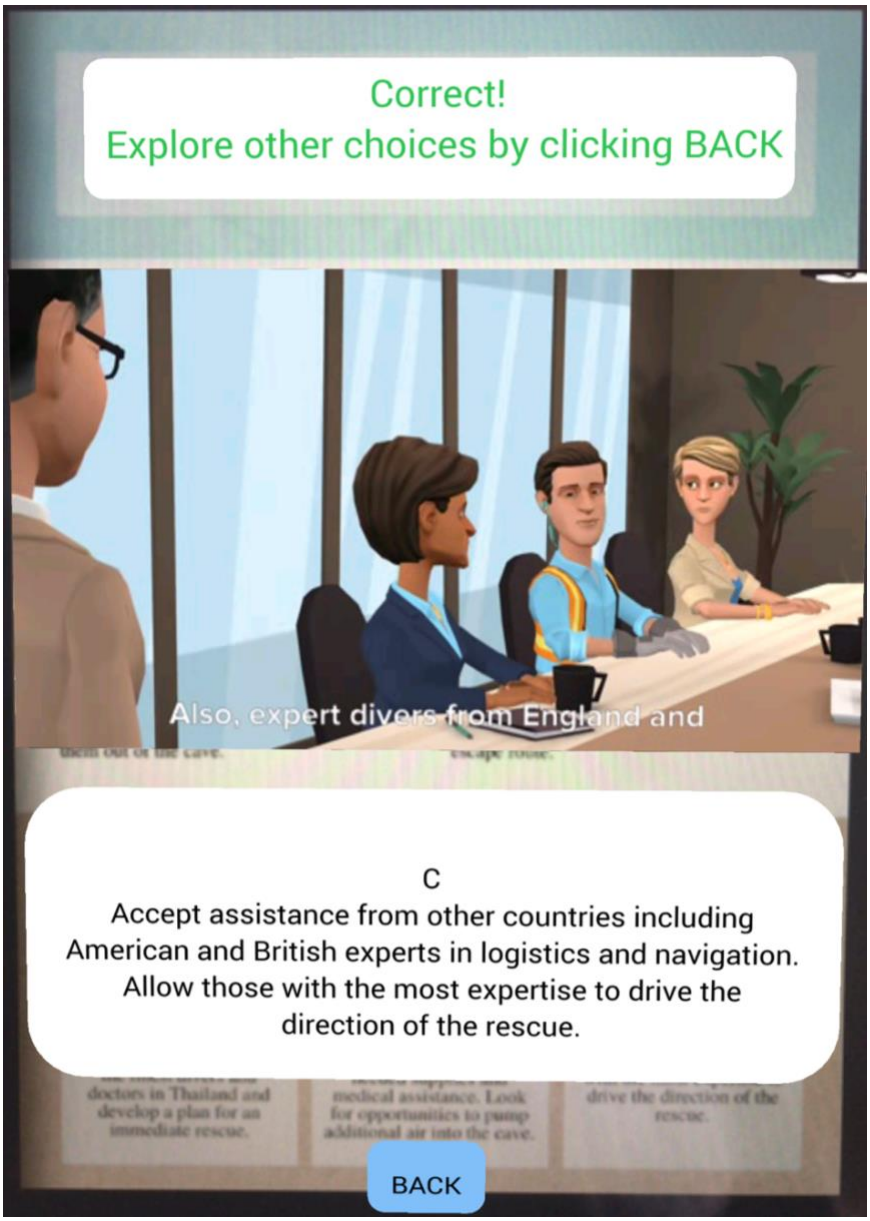


Figure 3.12

A screenshot of Consequence C page



Validation of the AR Application

A pilot study was conducted prior to the dissertation data collection process in order to validate the AR application and the learning content. Participants in the pilot study were four advanced educational leadership students. The population was able to evaluate the AR application

because they had experience in learning ethical dilemmas. Even though they did not have design experience, they were able to evaluate the learning content and the usability of the AR application. Participants reviewed two AR case studies regarding ethical dilemmas. Then, they took an AR application usability test survey and a self-efficacy in learning ethical dilemmas survey. The usability test survey mean score was 4.07 out of 5 likert-scale (81.47%). In other words, the participants agreed that the AR learning application was usable. The AR lesson seemed to cover topics that were important in educational ethics class. In addition, the pilot test participants reported that they were likely to increase their self-efficacy in learning ethical ethics. The overall mean of self-efficacy was 4.125 out of 5 (82.5%) which indicated that participants agreed they had confidence in their abilities to handle ethical dilemmas after using the AR application. In addition, the overall mean of the usability survey was 4.33 (86.67%). The results indicated that participants were able to use the AR application and that it assisted them to learn to deal with ethical dilemmas. The results showed that the AR learning content was able to support participants' self-efficacy in learning (82.50%). It was simple to use and was able to assist participants in learning ethical dilemmas (86.69%). From the interviews, participants gave positive feedback of the AR instruction, stating that it gained their attention, was interesting, refreshed their memory about things they'd learned when they took the class, provided guidance on how to handle situations, and was easy to access and simple to use. They also reported it was fun to see animated videos and the characters' interactions.

Data Collection and Procedures

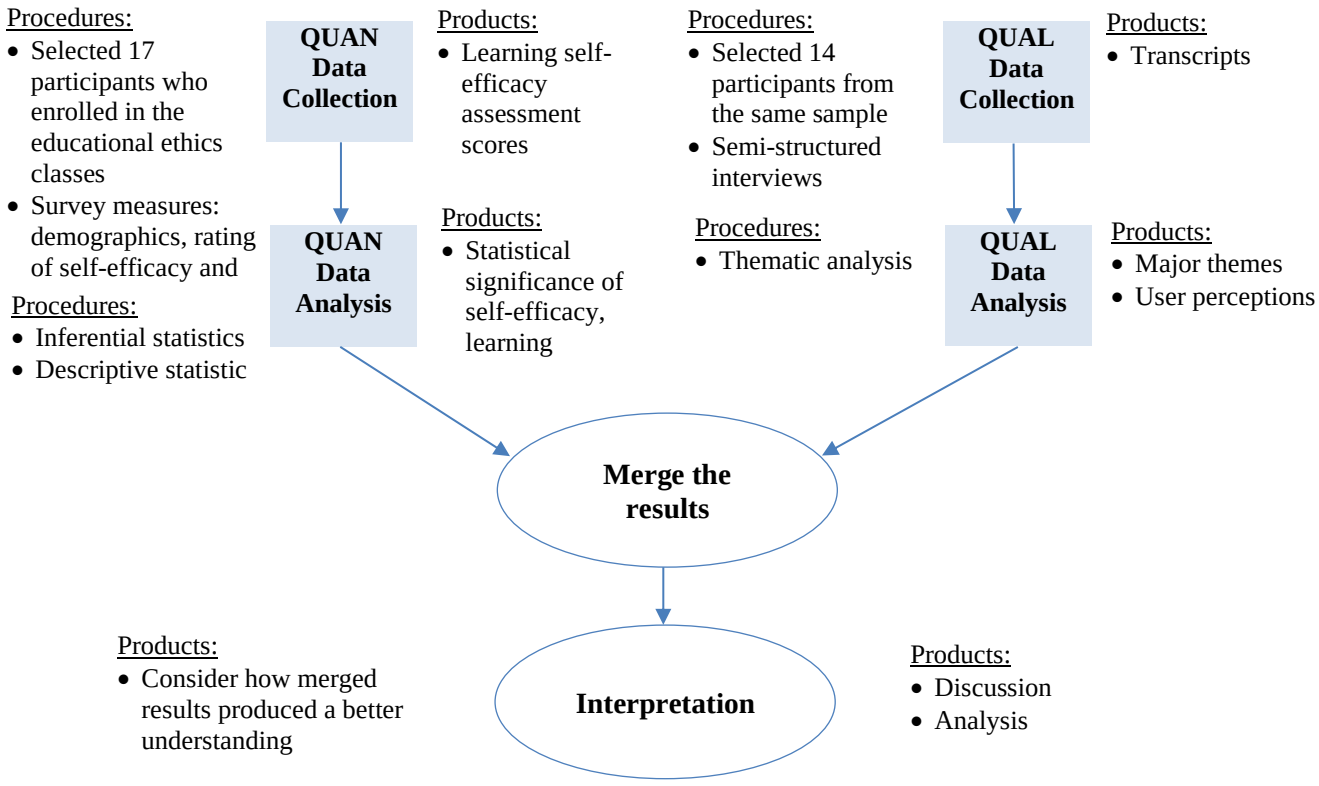
This study was conducted with a convergent parallel mixed-methods research design (Creswell & Plano Clarke, 2018). Quantitative and qualitative data was collected simultaneously and analyzed separately. Afterwards, the results were merged. The quantitative results answered the research questions about the effect of the AR application on participants' self-efficacy in

decision making regarding educational ethics, while the qualitative findings demonstrated how participants experienced the AR application to learn about solving ethical dilemmas.

The data sources came from pre-surveys, post-surveys, and interviews. Participants in quantitative research were 17 graduate students. They completed pre- and post- surveys before and after using the application. Participants in qualitative research were 14 students drawn from the quantitative research sample. They were asked to participate in the qualitative research phase. Qualitative participants were interviewed for 15 to 30 minutes. Data was collected in the Fall 2020 semester.

Figure 3.13

A procedure diagram



Quantitative Data Collection

The quantitative data was collected through pre- and post- surveys asking participants about their self-efficacy in solving ethical dilemmas. Participants took a pre-survey at the

beginning of the research study. Once they completed an online survey, they used the AR application to learn about ethical dilemmas. After they used the application and completed the AR lesson, they took a post-survey. These surveys were delivered online through Qualtrics.

The pre-survey included questions about demographics and users' self-efficacy in learning the topic and participants' experience using the AR application while learning. Demographics questions were the following:

a. Gender

b. Age

e. Computer knowledge level: beginner, expert

f. Have you ever used AR applications before?

g. Have you ever solved ethical dilemmas before?

h. How long have you worked in the administrator role?

A self-efficacy 5 Linkert-scale assessment was used as an instrument to evaluate participants' self-efficacy. Pre-survey questions (Table 3.1) and post-survey questions (Table 3.2) were adapted from the *self-efficacy survey* (Gilbert et al., 2018) the *School Administrator Efficacy Scale (SAES)* focusing on *the dimension of Data-based Decision Making Aligned with Legal and Ethical Principles* (McCollum & Kajs, 2009), the *technology self-efficacy and response-efficacy surveys* (Zhang et al., 2017), and the *task self-efficacy survey* (Holden & Rada, 2011). These surveys were shown in past studies to be valid or reliable (or both). The *self-efficacy survey* is considered to be reliable with Cronbach's alpha ≥ .70 (Gilbert et al., 2018). The *SAES* had sufficient evidence of validity and reliability (McCollum & Kajs, 2009). The *technology self-efficacy and response-efficacy surveys* were shown to have content validity and reliability (McCollum & Kajs, 2009). Both content validity and construct validity were assessed by Gilbert et al. (2018) and McCollum and Kajs (2009) to ensure the suitability of the surveys. In addition, reliability was assessed by composite reliability (CR > 0.700) and average variance extraction

(AVE > 0.700), which indicated good convergent validity (Zhang et al., 2017). Finally, the *task self-efficacy survey* had constructs that were statistically reliable (Holden & Rada, 2011).

The original phrasing of the questions was used to the greatest extent possible. However, minor wording changes were sometimes required to fit the context of the study. For example, the researcher added "AR learning activity" instead of "leadership preparation" in the original version.

Table 3.1

Pre-survey

Constructs	Items	Literature
Self-Efficacy Survey	1. I feel this AR learning activity will provide me with a strong knowledge-base for solving ethical dilemmas. 2. I feel very confident in my overall knowledge regarding solving ethical dilemmas. 3. I feel very confident in my ability to solve ethical dilemmas. 4. I feel very confident in my ability to handle difficult ethical dilemmas. 5. I feel this activity will enhance my ability to face ethical dilemmas.	Gilbert et al. (2018)
School Administrator Efficacy Scale (SAES): Data-based Decision Making Aligned with Legal and Ethical Principles	1. I can make sound decisions and am able to explain them based on professional, ethical and legal principles. 2. I am confident in my ability to understand and evaluate education research that is related to programs and issues in my (future) school. 3. I can explain to staff and parents the decision-making process of my (future) school district. 4. I can make decisions within the boundaries of ethical and legal principles. 5. I am able to explain the role of law and politics in shaping the school community.	McCollum and Kajs (2009)
Technology Self-efficacy	1. I anticipate that it will be easy for me to use the AR app.	Zhang et al. (2017)

	2. I anticipate that I will have the capability to use the AR app. 3. I anticipate that I will be able to use the AR app without much effort.	
Technology Response-efficacy	1. I anticipate that the AR app will assist me in learning ethical dilemmas. 2. I anticipate that the AR app will be effective in learning ethical dilemmas. 3. When using the app, my confidence to learn to face ethical dilemmas will be more likely to increase.	Zhang et al. (2017)
Task Self-efficacy	1. I anticipate that there will be no one around to tell me what to do as I go. 2. I anticipate that someone else will help me get started. 3. I had never used a technology like AR before.	Holden and Rada (2011)

The post-survey (Table 3.2) included questions about how well the AR lesson enhanced self-efficacy and facilitated learning.

Table 3.2

Post-survey

Constructs	Items	Literature
Self-Efficacy Survey	1. I feel this AR learning activity provided me with a strong knowledge-based for solving ethical dilemmas. 2. I feel very confident in my overall knowledge regarding solving ethical dilemmas. 3. I feel very confident in my ability to solve ethical dilemmas. 4. I feel very confident in my ability to handle difficult ethical dilemmas. 5. I feel this activity has enhanced my ability to face ethical dilemmas.	Gilbert et al. (2018)
School Administrator Efficacy Scale (SAES): Data-based Decision Making Aligned	1. I can make sound decisions and am able to explain them based on professional, ethical and legal principles. 2. I am confident in my ability to understand and evaluate education research that is	McCollum and Kajs (2009)

with Legal and Ethical Principles	related to programs and issues in my (future) school. 3. I can explain to staff and parents the decision-making process of my (future) school district. 4. I can make decisions within the boundaries of ethical and legal principles. 5. I am able to explain the role of law and politics in shaping the school community.	
Technology Self-efficacy	1. It was easy for me to use the AR app. 2. I had the capability to use the AR app. 3. I was able to use the AR app without much effort.	Zhang et al. (2017)
Technology Response-efficacy	1. The AR app assisted me in learning ethical dilemmas. 2. The AR app was effective in learning ethical dilemmas. 3. After using the app, my confidence to face ethical dilemmas has grown.	Zhang et al. (2017)
Task Self-efficacy	1. There was no one around to tell me what to do as I went. 2. Someone else had helped me get started. 3. I had used similar technologies before this one to do the same task.	Holden and Rada (2011)

Question: Would you like to be interviewed about your experience using the AR app for 15 to 30 minutes? Yes/No

Qualitative Data Collection

The qualitative data was collected through interviews. The interviews were recorded by using the Zoom recorder and doing naturalized transcription, which transcribed every word that participants said (Oliver, Serovich, & Mason, 2005). Patton (2015) recommends that an interviewer should ask open-ended questions; therefore, relevant and meaningful open-ended questions that promoted thoughtful, in-depth responses were asked. The guiding interview questions were as follows:

1. What was your experience in solving ethical dilemmas?

a. What do you know about ethical dilemmas?

b. Where and when did you first learn about ethical dilemmas?

2. What is your future career aspiration?
3. How do you think solving ethical dilemmas will equip you to be an effective leader?
4. What was your experience using Augmented Reality (AR) applications before this study?

a. What do you know about Augmented Reality?

b. Where and when did you first learn about AR?

5. What has been your experience using the AR application to learn about ethical dilemmas in this study?
6. How effective has the AR application been in guiding you while learning ethical dilemmas?

a. Did you have any difficulties? If so, can you tell me about them?

b. What did you like best about the AR application?

7. What other leadership skills would you like to learn in your profession that you might want the AR application to help you with?
8. Do you think this AR app helped you learn and be confident in solving ethical dilemmas?

a. How did AR instructions help you to learn and increase confidence in solving ethical dilemmas?

9. Do you have any recommendations for improving this AR application?
10. Is there anything else that you would like to tell me that I have not asked you about?
11. Do you have any questions that you would like to ask me?

Data Analysis

Both quantitative and qualitative data were analyzed separately. The quantitative data was analyzed by using descriptive and inferential statistics. The significance of the AR lesson's influence in enhancing learners' self-efficacy in learning educational ethics was analyzed. A

paired-sample t-test was used to compare the pre-survey and post-survey measures. Additionally, the qualitative data was analyzed by using thematic analysis which identified the main themes from categories and codes. The codes were rolled up into categories and the categories were developed into themes. The processes of thematic analysis are as follows. These steps were laid out by Braun and Clarke (2006).

1. The researcher transcribed the interview recordings by using Zoom transcript service and imported the transcripts into NVivo software.
2. The researcher familiarized themselves with the data by reading and re-reading the data on Nvivo.
3. The researcher generated codes based on research questions and theoretical framework.
4. The researcher categorized codes and searched for potential themes.
5. The researcher reviewed themes twice and named themes.
6. The researcher produced the report by using the cognitive theory of multimedia learning (Mayer, 1997) and self-efficacy (Bandura, 1997b) as theoretical frameworks to connect the research questions and literature.

Trustworthiness

The researcher enhanced the credibility and quality of qualitative analysis by reexamining initial findings and analyzing data deeply (Connelly, 2016; Shenton, 2004). The researcher reexamined initial findings by coding qualitative data for two cycles (Connelly, 2016) and analyzed qualitative data deeply by investigating both positive and negative perspectives from the participants (Connelly, 2016; Creswell & Plano Clarke, 2018; Shenton, 2004). In addition, the researcher analyzed quantitative data twice and categorized participants into various groups based on their prior administrative experiences and uses of AR technology. The researcher revisited both quantitative and qualitative data to confirm that all possible factors that made impact on participants' self-efficacy were involved. The researcher also examined the pilot study

and previous research findings to assess whether the findings were congruent with those previous studies.

Ethical Issues and Considerations

Patton (2015) recommends considering ethical practice by informed consent and confidentiality. He states that "the interviewer often provides [the information of the study] in advance of the interview and then again at the beginning of the interview…Statements of purpose should be simple, straightforward, transparent, and understandable" (p. 498). The process of conducting this study was approved by the IRB. An electronic consent form was distributed to participants before they participated in the study. Additionally, the data from the study was confidential.

Delimitations and Limitations

This mixed-method study was conducted in two educational ethics classes in which 17 graduate students participated. As a consequence, the sample size for quantitative research that compared between pre- and post- survey data was small. This study made an argument that AR could assist preservice educational leaders in learning educational ethics. However, some participants might have already had prior experience in their administrative roles. Some might be school principals or have previous experience as school administrators. Participants' self-efficacy level might be different based on their experiences of working and solving ethical dilemmas. Still, some participants were not familiar with solving ethical dilemmas. This study expected that the participating preservice educational leaders' perceptions of self-efficacy in dealing with making decisions based on educational ethics would increase after learning through AR materials. It was important for this study to understand a baseline of preservice educational leaders' self-efficacy and how that would be impacted after the AR intervention, as most educational leadership

classrooms are diverse, and preservice educational leaders come from different backgrounds and have various prior knowledge and experiences.

Summary

This mixed-methods study collected qualitative and quantitative data and analyzed both to find the answers to the main research question: what is the influence of an AR application that provides rich media problem-solving experiences on preservice educational leaders' self-efficacy for addressing ethical dilemmas? Quantitative data was collected prior to qualitative data. Instruments in the study included pre-/post- self-efficacy surveys and individual interviews. The collected quantitative data was analyzed through descriptive statistics and inferential statistics approaches. The collected qualitative data was analyzed through thematic analysis which identified the main themes from the coding nodes. The data was demonstrated by using appropriate visuals involving SPSS report graphs and data.

CHAPTER IV

FINDINGS

This study explores the impact of AR on preservice educational leaders' self-efficacy in learning how to solve ethical dilemmas. The quantitative and qualitative data analyses were used to answer the following research questions:

1. What is the influence of an AR application that provides rich media problem-solving experiences on preservice educational leaders' self-efficacy for addressing ethical dilemmas?
2. How do preservice educational leaders perceive the AR lessons and their effects on self-efficacy?
3. To what extent do the quantitative results on self-efficacy agree with the interview findings on preservice educational leaders' experiences with the AR app?

The findings demonstrate the results from pre and post surveys and the findings from individual interviews. Visuals and tables have been created to present the data in easy understanding formats.

Characteristics of Participants in the Quantitative Phase

Participants in this study were graduate students in an educational leadership program. Based on the 18 graduate students in two classes, *Leadership Theory and Ethical Decision Making and School Leadership, Culture and Ethics*, 17 students agreed to participate in the study.

They allowed the researcher to observe during the class activities. Fifteen students were willing to share their class assignments with the researcher. Fourteen students participated in follow-up interviews. The data collection processes took place virtually during the COVID-19 pandemic. Three participants were male (17.65%) and fourteen participants were female (82.35%). The participants' age ranges were 35-44 years old (35.29%), 25-34 years old (29.41%), 45-54 years old (23.53%) and 55-64 years old (11.76%). They considered their computer knowledge levels as intermediate (76.47%), expert (17.65%), and beginner (5.88%). The majority of the participants had not used AR applications before (47.06%). However, some of them had used AR applications (29.41%), and some were not sure (23.53%). The majority of the participants had experience solving ethical dilemmas (82.35%). Nevertheless, the minority of them did not have experience solving ethical dilemmas (11.76%). The participants' prior experience working as school administrators ranged from 0 to 23 years. Table 4.1 shows detailed information of participants.

Table 4.1

Participants demographic information

Participant ID	Gender	Age (years old)	Leadership Class Attended	Computer Knowledge Level	Previous used of AR applications	Experience in solving ethical dilemmas*	School administrative experience (year)
1	Male	45 - 54	Masters	Intermediate	Not sure	Yes	0
2	Female	35 - 44	Masters	Expert	No	Yes	6
3	Female	35 - 44	Masters	Intermediate	Yes	Yes	0
4	Female	25 - 34	Masters	Intermediate	Not sure	Yes	0
5	Female	25 - 34	Masters	Intermediate	Not sure	No	0
6	Female	35 - 44	Masters	Intermediate	Yes	Yes	2
7	Female	45 - 54	Masters	Intermediate	No	Yes	0
8	Female	25 - 34	Masters	Intermediate	No	Yes	0
9	Female	25 - 34	Masters	Intermediate	Yes	No	0
10	Male	45 - 54	Doctoral	Expert	Yes	Yes	23
11	Male	35 - 44	Doctoral	Expert	No	Not sure	0
12	Female	35 - 44	Doctoral	Intermediate	Yes	Yes	0
13	Female	45 - 54	Doctoral	Intermediate	No	Yes	0
14	Female	55 - 64	Doctoral	Intermediate	No	Yes	9
15	Female	35 - 44	Doctoral	Intermediate	No	Yes	2
16	Female	25 - 34	Doctoral	Intermediate	Not sure	Yes	2
17	Female	55 - 64	Doctoral	Beginner	No	Yes	15

Note: The researcher defined "experience in solving ethical dilemmas" as having prior experience in their previous work discussing and solving ethical dilemmas.

Table 4.2

Characteristics of participants in the quantitative phase (N=17)

	Groups	Frequency	Percent (%)
Gender	Male	3	17.65
	Female	14	82.35
Age range	25 – 34	5	29.41
	35 – 44	6	35.29
	45 – 54	4	23.53
	55 – 64	2	11.76
Leadership class attended	Masters	9	52.94
	Doctoral	8	47.06

Table 4.3

Participants' self-reported of computer knowledge levels and experiences in using AR, solving ethical dilemmas, and working as school administrators (N=17)

	Levels	Frequency	Percent (%)
Computer knowledge levels	Beginner	1	5.88
	Intermediate	13	76.47
	Expert	3	17.65
Previous use of AR applications	Yes	5	29.41
	Not sure	4	23.53
	No	8	47.06
Experience solving ethical dilemmas	Yes	14	82.35
	Might or might not	1	5.88
	No	2	11.76
School administrative experience	0 year	10	58.82
	More than 1 year	7	41.18

Quantitative Results

The pre and post surveys were analyzed using the *IBM SPSS Statistics 24* to investigate whether there was a significant difference between pre and post surveys on preservice educational leaders' self-efficacy in learning ethical dilemmas through AR materials. Participants were asked to rate each question on a five-point Likert-type scale.

Table 4.4

Descriptive statistical reports of the participants' self-efficacy of learning ethical dilemmas and use of AR learning materials

	N Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Mean Std. Error	Std. Deviation Statistic	Variance Statistic
1. Pre Ethics	17	3.00	4.90	3.974	.121	.498	.248
2. Post Ethics	17	3.60	4.90	4.053	.090	.373	.139
3. Pre AR	16	2.75	4.13	3.510	.104	.417	.174
4. Post AR	17	2.75	4.50	3.877	.130	.536	.287
Valid N (listwise)	16						

Table 4.5

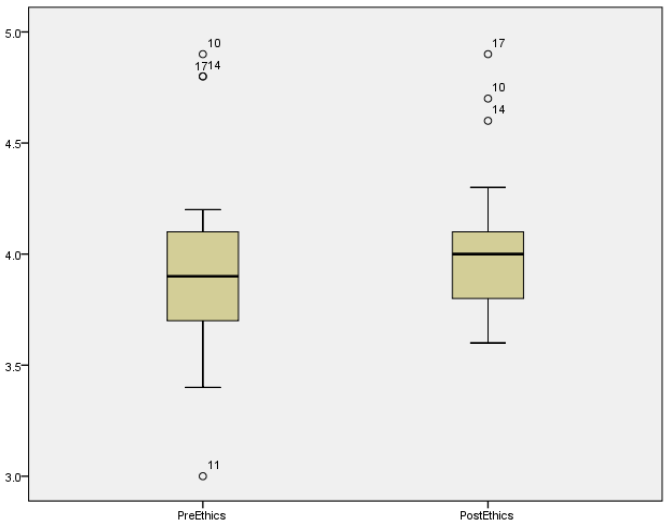
Paired Samples T-Test Report

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval Lower	95% Confidence Interval Upper	t	df	Sig. (2-tailed)
Pair 1 Pre-Post Ethics	.079	.332	.081	- .250	.092	- .978	16	.343
Pair 2 Pre-Post AR	- .359	.669	.167	- .716	.003	- 2.148	15	.048

The paired samples t-test statistical method was used to analyze significant differences between pre and post surveys. There was a significant difference in the scores for pre AR surveys (M = 3.51, SD = .417) and post AR surveys (M = 3.88, SD = .536); t (15) = - 2.148, p = .048. Participants reported higher self-efficacy with using AR applications after completing the AR exercise. The difference between pre and post test scores for self-efficacy in dealing with ethical dilemmas was not significant.

Figure 4.1

A plot represents the overall means between the pre- and post-surveys of participants' ethical dilemmas self-efficacy scales.



The inferential statistics (t-test) showed that participants had a higher mean in ethical dilemmas' self-efficacy scales after they performed the AR learning task. However, there was no significant difference in self-efficacy levels before and after the performed task.

Figure 4.2

A plot represents the overall means between the pre- and post-surveys of participants' AR self-efficacy scales.

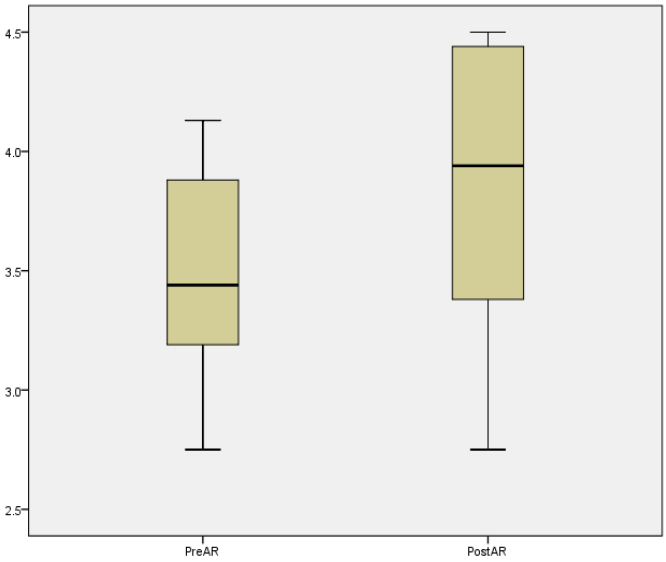


Figure 4.2 illustrated that participants had higher self-efficacy in using AR after they performed the AR learning task. The inferential statistics (t-test) showed that participants had significantly higher self-efficacy levels in using AR after they performed the AR learning task. The survey scores are presented in Table 4.6 - 4.7.

Table 4.6

Participants' self-reported self-efficacy for solving ethical dilemmas

Question	Pre-Survey		Post-Survey	
	Mean	SD	Mean	SD
1. I feel this AR learning activity will provide/provided me with a strong knowledge-base for solving ethical dilemmas.	3.59	0.69	3.53	0.70
2. I feel very confident in my overall knowledge regarding solving ethical dilemmas.	4.12	0.58	4.24	0.42
3. I feel very confident in my ability to solve ethical dilemmas.	4.12	0.58	4.29	0.46
4. I feel very confident in my ability to handle difficult ethical dilemmas.	3.88	0.68	4.18	0.51
5. I feel this activity will enhance/has enhanced my ability to face ethical dilemmas.	4.00	0.69	3.76	0.88
6. I can make sound decisions and am able to explain them based on professional, ethical and legal principles.	4.06	0.64	4.12	0.47
7. I am confident in my ability to understand and evaluate education research that is related to programs and issues in my (future) school.	4.00	0.59	4.12	0.32
8. I can explain to staff and parents the decision-making process of my (future) school district.	4.18	0.51	4.18	0.51
9. I can make decisions within the boundaries of ethical and legal principles.	4.00	0.61	4.18	0.38
10. I am able to explain the role of law and politics in shaping the school community.	3.82	0.62	3.94	0.73
Average	3.97	0.50	4.05	0.37

Table 4.7

Participants' self-reported self-efficacy for using AR learning materials

Question	Pre-survey		Post-survey	
	Mean	SD	Mean	SD
1. I anticipate that it will be/was easy for me to use the AR app.	3.50	0.79	4.71	0.46
2. I anticipate that I will have/had the capability to use the AR app.	3.94	0.56	4.65	0.48
3. I anticipate that I will be/was able to use the AR app without much effort.	3.56	0.61	4.53	0.61
4. I anticipate that the AR app will assist/assisted me in learning ethical dilemmas.	3.56	0.50	4.00	1.08
5. I anticipate that the AR app will be/was effective in learning ethical dilemmas.	3.44	0.50	4.00	1.03
6. When/After using the app, my confidence to learn to face ethical dilemmas will be more likely to increase/has grown.	3.56	0.50	3.41	1.9
7. While using the app, I anticipate that there will be/was no one around to tell me what to do as I go/went.	3.63	0.93	3.35	1.23
Average	3.51	0.42	3.88	0.54

Additionally, the participants were categorized into different groups of administrative and AR experiences in order to investigate whether the participants' experiences in administrative roles and uses of AR influenced their self-efficacy.

1. Participants who had administrative experiences

There were 7 participants who had administrative experiences. Their experiences ranged from 2 to 23 years. The paired samples t-test was used to investigate whether there was any statistically difference between the participants' self-efficacy levels before and after the AR exercise. Pair 1 compared the participants' self-efficacy levels in learning ethical dilemmas. Pair 2 compared their self-efficacy levels in using AR.

Table 4.8

Descriptive statistical report of the self-efficacy levels of participants who have administrative experience when learning ethical dilemmas and using AR learning materials

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre Ethics	4.314	7	.498	.188
	Post Ethics	4.300	7	.424	.160
Pair 2	Pre AR	3.627	7	.434	.164
	Post AR	3.949	7	.589	.223

Table 4.9

Paired samples t-test report of participants with administrative experiences

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval		t	df	Sig. (2-tailed)
				Lower	Upper			
Pair 1 Pre-Post Ethics	.014	.134	.051	- .110	.139	- .281	6	0.788
Pair 2 Pre-Post AR	- .321	.591	.224	- .869	.226	- 1.437	6	0.201

On average, participants with administrative experiences had less self-efficacy levels in learning ethical dilemmas (M = 4.30, SE = .160), than before they completed the AR exercise (M= 4.31, SE = .18). This difference, .014, 95% CI [- .11, .14], was not significant t (6) = .28, p = .778. In contrast, they had higher self-efficacy levels in using AR (M = 3.95, SE = .22), than before they completed the AR exercise (M = 3.63, SE = .16). This difference, - .32, 95% CI [- .87, .23], was not significant t (6) = - 1.44, p = .201.

2. Participants who did not have administrative experience

There were 10 participants who did not have administrative experience.

Table 4.10

Descriptive statistical report of the participants' self-efficacy who do not have administrative experience when learning ethical dilemmas and using AR learning materials

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre Ethics	3.736	10	.349	.110
	Post Ethics	3.880	10	.215	.068
Pair 2	Pre AR	3.419	9	.406	.135
	Post AR	3.808	9	.550	.183

Table 4.11

Paired samples t-test report of participants who did not have administrative experience

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval		t	df	Sig. (2-tailed)
				Lower	Upper			
Pair 1 Pre-Post Ethics	- .144	.416	.131	- .441	.153	- 1.096	9	.302
Pair 2 Pre-Post AR	- .389	.758	.253	- .972	.194	- 1.538	8	.163

On average, participants who did not have administrative experience had higher self-efficacy levels in learning ethical dilemmas (M = 3.88, SE = .068), than before they completed the AR exercise (M= 3.74, SE = .110). This difference, - .14, 95% CI [- .44, .15], was not significant t (9) = - 1.10, p = .302. In addition, they had higher self-efficacy levels in using AR (M = 3.81, SE = .18), than before they completed the AR exercise (M = 3.42, SE = .14). This difference, - .39, 95% CI [- .97, .19], was not significant t (8) = - 1.54, p = .163.

3. Participants with AR experience

There were 5 participants who had previous experience using AR.

Table 4.12

Descriptive statistical report of the AR experienced participants' self-efficacy when learning ethical dilemmas and using AR learning materials

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre Ethics	4.080	5	.466	.208
	Post Ethics	4.060	5	.404	.181
Pair 2	Pre AR	3.940	4	.163	.081
	Post AR	3.815	4	.599	.300

Table 4.13

Paired samples t-test report of participants with AR experience

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval		t	df	Sig. (2-tailed)
				Lower	Upper			
Pair 1 Pre-Post Ethics	- .020	.179	.080	- .202	.242	- .250	4	.815
Pair 2 Pre-Post AR	- .125	.646	.323	- .902	1.152	- .387	3	.724

On average, participants who had AR experience had lower self-efficacy levels in learning ethical dilemmas (M = 4.06, SE = .181), than after completing the AR exercise (M= 4.08, SE = .208). This difference, - .02, 95% CI [- .20,.24], was not significant *t* (4) = - .25, *p* = .815. In addition, they had lower self-efficacy levels in using AR (M = 3.82, SE = .30), than after completing the AR exercise (M = 3.94, SE = .08). This difference, - .13, 95% CI [- .90, 1.15], was not significant *t* (3) = - .39, *p* = .724.

4. Participants without AR experience

There were 8 participants who did not have previous experience using AR.

Table 4.14

Descriptive statistical report of the self-efficacy levels of participants who do not have AR experience when learning ethical dilemmas and using AR learning materials

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre Ethics	4.013	8	.599	.212
	Post Ethics	4.163	8	.410	.145
Pair 2	Pre AR	3.470	8	.383	.135
	Post AR	4.126	8	.449	.159

Table 4.15

Paired samples t-test report of participants with non-AR experience

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval		t	df	Sig. (2-tailed)
				Lower	Upper			
Pair 1 Pre-Post Ethics	- .150	.417	.148	- .499	.199	- 1.016	7	.343
Pair 2 Pre-Post AR	- .656	.611	.216	- 1.167	.146	- 3.040	7	.019

On average, participants without AR experience had higher self-efficacy levels in learning ethical dilemmas (M = 4.12, SE = .145), than before they completed the AR exercise (M= 4.01, SE = .212). This difference, -.15, 95% CI [- .50, .20], was not significant *t* (7) = - 1.02, *p* = .343. In addition, they had higher self-efficacy levels in using AR (M = 4.13, SE = .159), than

before they completed the AR exercise (M = 3.47, SE = .14). This difference, - .66, 95% CI [-1.17, .15], was significant t (7) = - 3.04, p = .019.

To summarize, participants who did not have AR experience had higher self-efficacy levels in using AR after they completed the AR exercise. However, there were no significant differences among participants who had AR experience or among those with and without administrative experience.

Qualitative Findings

This section demonstrates the individual interview data based on the research question: "How do preservice educational leaders perceive the AR lessons and their effects on self-efficacy?" Fourteen preservice educational leaders who are graduate students in the leadership classes agreed to participate in follow-up individual interviews through Zoom after they completed the AR exercise and took a post survey. The interviews were recorded and transcribed through Zoom. Participants' responses were transcribed and coded. The guided individual interview questions are in Appendix F.

The qualitative interview data demonstrated that participants had positive perceptions of the AR lesson and suggested some recommendations to improve it. They explained how the AR lesson increased their self-efficacy in learning how to deal with ethical dilemmas. The analyzed themes, categories, and codes are demonstrated in Table 4.16.

Table 4.16

Analyzed themes, categories, and codes

Themes	Categories	Codes	Participants	Frequency
1. Positive perception on AR lesson	Enjoyment	Participants liked the AR lesson.	7	9
		Participants enjoyed learning the AR lesson.	5	7
	User friendly	The AR application was easy to use.	12	15
		The AR application was	4	4

		straightforward.		
	Learning engagement	Participants engaged in the AR lesson.	4	5
		Participants were interested in the AR lesson.	4	5
		The AR lesson grabbed participants attention while learning.	2	3
2. Self-efficacy effects on AR lesson	Guidance	Participants were able to receive information and guidance.	3	5
		Participants could understand the lesson.	3	3
		Participants were able to see the outcomes.	5	7
	Choice	AR lesson showed multiple options.	7	9
	Ability to make decisions	Participants were able to make decisions.	4	6
		Participants were able to reflect and discuss.	1	2
	Engagement	Participants felt like they were part of the scenario.	3	3
		Participants were able to interact with the information.	2	2
	Visually process	Participants were able to see graphics and virtual characters.	5	7
		Participants were able to see both visual content and physical worksheet.	1	1
	Encoding to Memory	Participants remembered something they have seen.	4	4
		Participants practiced decision making.	2	2
		Participants were able to reinforce what they already knew from the reading.	1	1
3. Suggestion on AR lesson	Implementation	Participants suggested other leadership skills that AR lessons can teach.	13	15
		Participants suggested how to apply AR in their professions.	11	17
	Improvement	More directions	4	4
		More case studies	2	4
		More questions	2	4
		Longer activity	1	1
		Shorter video	1	1

Theme 1: Positive Perceptions on AR Lesson

Participants expressed positive perceptions toward the AR lesson by expressing their enjoyment in learning. They agreed that the AR application was easy to use. They also engaged in learning the AR lesson.

1.1. Enjoyment

Participants liked and enjoyed learning the AR lesson.

a. Participants liked the AR lesson.

Participants expressed that they liked using the AR lesson. They had various reasons explaining why they liked it. For example, the AR lesson contained engaging graphics, it allowed them to make decisions, and the AR application was easy to use. Participant 5 expressed, "I really liked the [AR] app. I like the convenience of being able to scan something. I like the graphics of it." In addition, Participant 1 stated that he liked the AR lesson because it enabled learners to make decisions.

> I liked that you could make decisions. So, I didn't remember specifically what decisions were made in that situation. I didn't remember. But I enjoyed that I could make a decision. And it was my decision. And then I could find out if I was right about the decision I made. I like that (Participant 1).

Participants also expressed that they enjoyed learning the AR lesson. For example, Participant 13 stated, "I liked it. I really did. I really enjoyed it". The participant further expressed that she would like to use it more and apply in a classroom both in a lecture mode and home assignments.

b. Participants enjoyed learning the AR lesson.

Participants expressed their enjoyment in learning the AR lesson. They would like to use the AR application more in classrooms. Participant 6 stated,

> I enjoy it. I actually wish that we would have it more, you know, I think it would be a great tool for not just students to use but teachers and professors. I'm especially like if

you're doing case studies or any type of collaborative work (Participant 1).

In addition, Participant 13 expressed her excitement with the story in the lesson:

Oh, that would be cool to use in ethical studies and since I never used it before. I thought that was just to bring something to life for the story to be read aloud and then presented in a real time, real life kind of situation was really cool. I really enjoyed that (Participant 13).

Participant 7 mentioned, "I really enjoyed the study and being able to like live it through that augmented reality and read through that app that you use was a really interesting way to get that information out to the students." In the same way, Participant 4 stated, "I really enjoyed learning something new and learning about this application and how you can use it." She further said, "I thought it went really well. I can enjoy the app, and I may play around and try to use it in my classroom." Moreover, Participant 3 expressed that, "It felt a little more like have a more of a fun experience, kind of like who I'm actually getting to be part of this and not just looking from the outside" Overall, participants' enjoyment is based on their excitement to see the story and participate in the engaging lesson.

1.2. User Friendly

Participants mentioned that the AR application was user friendly. The way the content was laid out was easy to understand and guided learners to go through the learning process and make ethical dilemma decisions. They stated that the application was easy to use and straightforward.

a. The AR application was easy to use.

Participant 4 stated that, "I thought it [the AR application] was very easy to use and very user friendly...I like the way it allowed me to see the different decisions and that were being made in choices." In the same way, Participant 13 expressed, "It's easy to use. The download was easy to use…it was a very easy to use tool." Participant 11 stated, "It was pretty easy to use… sometimes you have certain apps that do things and it's complicated, but that particular app was very easy to operate". Participant 9 also said, "I felt it was really easy to use. I did it on my

phone, the app was easy to download and it was easy to answer the questions as we went through it…and I liked the way it was designed so I enjoyed it". Even though some participants had not used AR before, they still were able to use the AR application well. Participant 15 mentioned, "This was the only one I've ever done. So, I thought it was easy to use. Umm and I like that it allowed you to do all three scenarios. So, you could see why they thought that was a good idea or bad idea."

Additionally, Participant 17 expressed that the way the AR content was laid out was easy to understand the process of AR exercise. She stated,

> The way it was. It was laid out. I like the process that it took you through. And I like that it was very easily. It was very easy to understand the process because of the way you would lay it out. And the process that it takes you through… It was easy to look at how it walks you through the process of scenarios on. I think that's what helped me, umm I was looking at it through the lens of being a new administrator and how would this help, help me if I were new in that position. And I think just, again, the way that the way it was laid out, the font, the descriptive words, the column, the way it was in columns and help me follow along (Participant 17).

Participants agreed that the AR application was simple to operate and easy to understand the overall process.

b. The AR application was straightforward.

Besides the AR application's simplicity, participants stated that its navigation was straightforward. Participant 6 mentioned,

> In a sense of sometimes with apps, you have to go to one thing that leads you to another thing. And then, you know, it was very straightforward. So, I guess navigation. I guess that's the word I'm looking for (Participant 1). In addition, Participant 7 said,
>
> It was straightforward. It's something that wasn't difficult for us to get signed in, and I

> think any technology that we use in the classroom or even with teachers like [or in] a group of people. It needs to be something that's used that's easy to get into to have access and it was a really smooth process (Participant 7).

In the same way, Participant 17 compared the AR navigation to shortcuts. She stated, "it was like shortcuts. It was like very precise very concise and it helped me get a little small nugget of understanding [of the] admitted ethical dilemma." Since the AR application was easy to use and its navigation was straightforward, participants were able to get into the lesson quickly and engage in the learning content.

1.3. Learning Engagement

Participants engaged and were interested in learning the AR lesson. They mentioned that the AR lesson grabbed their attention while learning.

a. Participants engaged in the AR lesson.

The interactive part of the AR lesson and the story about an ethical dilemma containing virtual characters made participants engage in learning. Participant 13 stated,

> [The AR lesson] just brought the story to life more and more where I could understand [and] comprehend what was going on. And they're really engaged with what the story was about (Participant 13).

In the same way, Participant 9 expressed, "I liked how it was set up, how it kind of seemed like you were being brought like an evening broadcast. Like, this is what's happening. The little like virtual characters. I thought it was like engaging." Additionally, Participant 14 asserted, "I think [the AR lesson] could just be another tool for being able to engage in learning." Participants agreed that having virtual characters illustrating the story such as an evening broadcast and the ethical dilemma made them engage in the lesson.

b. Participants were interested in the AR lesson.

Participants expressed their interests in the AR lesson in both learning a new tool with AR and the ethical dilemma story. Participant 7 expressed, "I thought [the AR lesson] was

interesting. Again, I haven't done that before, but I liked how it organized everything for us and how we were all again able to access it at the same time". Participant 3 stated, "[The AR lesson] was interesting to be in that experience and learn about the you know the decision-making process". Additionally, participants also were interested in the story that the lesson provided. Participant 11 stated, "[The AR lesson] just made me more interested in what I was learning about with that team. And what happened with them than if I were just to read it by myself." In the same way, Participant 7 was interested in the story. She mentioned,

> And this the study subject was really interesting as well with the students. The children who were stuck in the cave. So many dilemmas that faced—that they had to face to overcome all of these hurdles that were put in front of them that could have caused you know literally cause [the] death of the children. There were some really gray areas and they made some really tough decisions (Participant 7).

The story about the soccer team who was stuck in the cave in the AR lesson, and a unique way of experiencing AR enthused students to be interested in learning.

c. The AR lesson grabbed participants' attention while learning.

Some participants thought that the AR lesson grabbed their attention while learning ethical dilemmas. For example, Participant 11 said, "I think it grabbed my attention, more than I think normally if you were just teaching about Ethics and having a dilemma… It made me want to pay attention to what I was doing". This statement revealed that the AR lesson had the ability to grab participant's attention more than a normal teaching method would when it came to learning ethical dilemmas. Additionally, Participant 14 stated her experience learning the ethics case study with the AR application that:

> [The AR application] kept my attention. And I got the answer right. You know, I chose C because I know right now. A big theme is just that we're working, we are better together. And so, I knew that that was the correct answer. And so, the experience just kind of solidified what I already knew to be correct (Participant 14).

This message showed that the activity of choosing the correct answer among A, B, and C when solving the ethical dilemma could keep the participant's attention. The right answer confirmed the participant's thought in making decisions dealing with the dilemma. Overall, participants perceived the AR lesson with positive attitudes. They liked the AR lesson and enjoyed learning it. The main reasons were that it was user friendly with its easy-to-use functions and straightforward navigation. In addition, participants engaged and paid attention in the lesson. They were interested in the case study embedded in the lesson and also willing to use AR more in classrooms.

Theme 2: Self-Efficacy Effects on AR Lesson

According to the second research question, "How do preservice educational leaders perceive the AR lessons and their effects on self-efficacy?" This section aims to answer how the AR lessons effected preservice educational leaders' self-efficacy. From the analyzed data, factors that increased participants' self-efficacy include guidance, choice, ability to make decisions, engagement, visually process, and remembrance. The AR lesson enabled participants to receive guidance in learning ethical dilemmas through case study and interactive choices for decision making. The AR exercise containing choice allowed participants to make decisions in solving the dilemmas. The analysis showed that participants engaged in the lesson. Additionally, they were able to process the lesson virtually, which made them remember content, rather than learning by text alone.

2.1. Guidance

The AR lesson encouraged participants to explore other options. For example, they could see other consequences of their decision making. Therefore, participants were able to receive guidance in dealing with the dilemma issue.

a. Participants were able to receive information and guidance.

The AR lesson allowed participants to receive information and guidance. Participant 6 stated, “I think across the board, it gave the information on a platform”. Some participants stated that they believed the AR application could be used to guide new school administrators. Participant 17 explained,

> I think it would serve to set up a new administrator. I think it would serve to help guide them in making ethical decisions. Definitely … It was like a guidepost. It helped direct you to understanding or following along with how to make the best ethical decisions (Participant 17).

The AR lesson was able to fully guide participants through both correct and incorrect choices, so they could learn about the consequences of multiple different decisions made during a crisis scenario.

b. Participants could understand the lesson.

The AR lesson provided information that helped students understand the lesson. Participant 4 stated, “[The AR lesson] gave me my choices. It helped pick what I thought was best and it kind of gave me why they chose that and why it ended up being the best for the situation.” This means that the participant could see the consequence of the appropriate choice. In the same fashion, Participant 13 asserted, “Well, it gave the scenarios and [you] choose the best one. And then it gave the facts behind why this answer would have been the best one and not the other ones. I like the feedback that it gave.”

c. Participants were able to see the outcomes.

Since the AR lesson allowed participants to see the outcomes, they were able to see if their thought was appropriate or not. For example, Participant 15 mentioned, “I like that it allowed you to do all three scenarios. So, you could see why they thought that was a good idea or bad idea.” In addition, participants were able to go back and review other consequences at other choices. Participant 12 stated,

To especially at the end. Like, even after you had selected the correct answer it encouraged you to go back and select the wrong answer so that you could see how things played out. I think that that helps people learn how to reframe and see things from another person's point of view. So, I thought that was good (Participant 12).

Participants were able to see the outcomes of their decision making. These outcomes could guide them the appropriate ways to act regarding the dilemma.

2.2. Choice

The AR lesson showed multiple options including choices A, B, and C. Participant 4 expressed,

I thought the application was really good. It gave you the situation and then it gave you the three choices you have up front so it gave you a chance to kind of process and the different choices you have to decide what's the best option… I like the way that it allowed me to see the different decisions that were being made in choices (Participant 4).

Participant 4 further stated that three choices were appropriate. She stated, "When you do more than three, you're kind of getting into logistics, where they all kind of intertwined together at some point. I think [it] is probably a good choice." Additionally, Participant 1 stated,

I like having the options to do this. If you choose A and then this happens or this happens, If you choose B, then this happens. And this happens or if you choose C then this and this, I like those kinds of things. So, I would want, I would like for that to be in future augmented reality situations (Participant 1).

Participant 6 asserted,

What it does is that it allows you to see multiple options, you know, and instead of a lot of times when you are, you know, dealing with something right there in person. You don't really have the time to sit back and think about all of the options. So as the, you know, including a program. As such, it gives you time to actually look at all of the evidence and to get feedback from other people before having to make a decision

(Participant 1).

Participant 10 asserted,

> And then, of course, go back and look what the other options [are]. I did like how we could go back and choose the wrong answers as a guess and see what, why they were the wrong answers because a lot of times you make decisions and you don't have that capability (Participant 10).

2.3. Ability to Make Decisions

The AR lesson allowed participants to make decisions regarding the ethical dilemma. It enabled participants to reflect and discuss the dilemma.

a. Participants were able to make decisions.

The AR lesson enabled participants to make their decisions. Participant 1 stated, "I like being able to make my decision. And then finding out if I made the right decision or the wrong decision and what decision was really made. Its autonomy. I like autonomy." In other words, Participant 1 liked the way the AR lesson allowed him to make decisions and review the consequences whether his decision is correct or not. Additionally, Participant 10 claimed that,

> I think you know, it would be a great opportunity for especially new prospects that are novice to administration, whether it's principal assistant principal, assistant superintendent, superintendent, whatever, to be able to have something like this… it could probably be a great tool for them to tackle several scenarios… something that somebody can just kind of fiddle around with on their extra time and see how different things go. And if there is a directory of different types of case studies or whatever. I'm sure people would use that to kind of see where they stand on their own decision-making processes (Participant 10).

Participant 10's point is that new administrators can use the AR lesson to learn various scenarios and acknowledge consequences of their decisions being made.

b. Participants were able to reflect and discuss.

Besides the AR lesson enabled participants to make decisions, it allowed them to reflect and discuss ethical dilemmas. According to Participant 7,

> It was a really nice use of the technology to help us with our ethical situations with making those decisions and discussing them… And be able to process it and be able to reflect with each other about those dilemmas and those decisions (Participant 7).

Basically, Participant 7 was saying this AR lesson allowed participants to make decisions and reflect about the dilemmas and decisions. Overall, the ability to make decisions in the AR lesson can enhance participants' self-efficacy in learning how to solve ethical dilemmas.

2.4. Engagement

Besides the AR lesson enabling participants to make decisions, it caused participants to engage in learning.

a. Participants felt like they were part of the scenario.

Participants engaged in the AR lesson by feeling like they were part of the scenario. They were able to learn by their own paths and interact with the information. Participant 9 mentioned,

> I do feel like [the AR lesson] definitely helped me learn and be confident. I honestly would like to do more, [I] felt like it was good to have you put yourself in a scenario and think about what you would do. I think it'd be really interesting to see it implemented in more and more graduate classes and even in undergrad classes, thinking back to when I was an undergrad student, and I think that could have been a really cool tool that could have been used (Participant 9).

The essence of Participant 9's argument is that she felt being part of a scenario and decided what the character would do to solve the dilemma. AR helped her learn the lesson and be confident in solving the ethical dilemma. She also suggested using this type of AR exercise in other graduate and undergraduate classes. Participant 3 also agreed with the concept of being part of the dilemma. She stated,

> I think it was really neat to just kind of have, um, you are involved in the program. And so, it made you feel like you are part of it, instead of just reading about it and trying to…It felt a little more like having more of a fun experience, kind of like I'm actually getting to be part of this and not just looking from the outside (Participant 3).

Participant 3 further claimed that she felt involved in the process and was sitting at the table in the scenario. Instead of just reading the story on a paper, she felt part of the situation.

b. Participants were able to interact with the information.

Furthermore, the AR lesson enabled participants to interact with the content. Participants were able to fully engage with the material and learn the ethical decision necessary during a crisis scenario. Participant 7 stated, "I think [the AR lesson] did help me learn better." Additionally, the virtual story helped participants to understand the ethical story as Participant 13 asserted, "[The AR lesson] just brought the story to life more and more where I could understand [and] comprehend what was going on." In the same way, Participant 11 stated that the AR lesson helped him understand the lesson in depth:

> The way that I process when I was doing that lesson when we were talking and doing going through that. Like I said, I really feel like I was understanding it, but it was in a different way than if I was just reading the material. So, if that can happen with our students. That's a really amazing tool to be able to use for students, even me as a student to understand things much more in depth (Participant 11).

This statement showed that the AR lesson assisted the participant to understand the lesson more than just reading the material.

2.5. Visually Process

Participants were able to visually process information from the AR lessons since they could see graphics and virtual case study characters.

a. Participants were able to see graphics and virtual characters.

The AR lesson enabled participants to see graphics and virtual characters on a mobile application screen. Participant 11 stated,

> I felt like I was able to get more out of the article and the discussion because I was able to use that app and do that process virtually. I think that just kind of, I don't know. It's almost like I was using a, maybe a different part of my brain to process. Then, if I'm just reading. I don't know if that's even possible, but I don't know how I would describe it, but it's almost like I was processing things cognitively a different way than I would have just reading it. If that makes sense (Participant 11).

Some participants discussed about the ability that the AR application could show visuals and how they liked it. For example, they stated:

- [The AR lesson] was able to show visuals with it (Participant 7).
- I liked that [the AR lesson] was animated and it had a real live look to the characters on it. I like the animation (Participant 5).
- What did I like best? I would have to say the functionality like the look of it. It looked realistic… I like the graphics of it (Participant 5).
- I liked how it was set up, how it's kind of seemed like you were being brought like an evening broadcast. Like this is what's happening. The little like virtual characters. I thought it was like engaging (Participant 9).

b. Participants were able to see both visual content and physical worksheet.

Additionally, AR allowed participants to see both visual content on a mobile screen and a PDF worksheet located behind a mobile camera. Participant 14 mentioned,

> …it just, the visual graphics of it, you know, being able to see the picture, but I can still see what was behind my phone. So, it makes your phone look like it's see through, and that's just kind of cool (Participant 14).

Due to AR's ability to show both virtual content and physical objects, participants were able to process information virtually. This led them to remember the learning content from seeing virtual characters in the ethical dilemma story.

2.6. Encoding to Memory

Participants remembered something they had seen on the case study video. In addition, they were able to reinforce what they already knew from the reading.

a. Participants remembered somethings they have seen.

Once participants practiced decision making from the AR lesson, they were able to remember how to deal with the situation. Participant 7 said, "I think when you're able to interact with the information that you learn it better and you retain it more." This means that this interactive AR lesson helped students to learn and remember the lesson. In the same fashion, Participant 1 stated,

> I think it would make a place in my brain where they would actually stay and cut in and be able for me to remember whenever I'm a principal and I come across some kind of ethical dilemma and my brain accesses that time that I used augmented reality in this case study. I know for me, it would be more likely for me to remember something I'd seen and experienced in augmented reality than it would be something I read without a doubt (Participant 1).

Furthermore, Participant 15 stated,

> I think it's helpful in just getting you to think through like in that case study there and it helps you think through, like, why that may not have been a good idea, or how it could have been better executed and so just helping you think through all those scenarios. So, when you encounter a similar scenario, you can already know. So, it helps you to practice and think through all different avenues of the scenario (Participant 15).

Participant 17 also agreed that the augmented decision-making lesson could help with the remembering process about how to appropriately handle the situation. She expressed,

> Playing [the AR lesson] in the head just rehearsing it and trying to learn how to make the best ethical decisions because again, when I say new administrative that old [have to deal with scenarios that are] new sometimes. It may be the first time that you've dealt with a particular situation. So, you don't know the best way to handle it. So that it'll be augmented reality decision making tool, I think helps with that process (Participant 17).

b. Participants practiced decision making.

Additionally, participants had an opportunity to practice decision making from the AR exercise. Participant 15 stated,

> I think even with this AR, you could do multiple studies of it and it just helps you become more confident that you were choosing the right thing. So, when in real time you have something you could be more confidence because you kind of practiced (Participant 15).

The statement implies that this AR practice could make Participant 15 to be more confidence in learning ethical dilemmas.

c. Participants were able to reinforce what they already knew from the reading.

Besides the opportunity to practice decision making, participants were able to reinforce what they already knew from the reading. Participant 14 stated, "[The AR lesson] reinforced what I already knew to be true from our reading so. It kind of took the reading, we did in our textbook to the next level." Learning from the case study video helped the participants strengthen knowledge from their textbooks. Overall, these statements revealed that the case study video from the AR learning material helped participants remember the lesson and be confident in making decisions when they face a similar situation. In addition, participants' hands-on experience of learning by interacting with the AR learning content could help them learn and retain information.

Theme 3: Suggestions on AR Lesson

Besides positive perceptions from the participants on their experiences in learning the AR lesson, they suggested ways to implement the AR lesson in classrooms and how to improve it. This theme addressed the research question: "How do preservice educational leaders perceive the AR lessons and their effects on self-efficacy?"

3.1. Implementation

The previous theme demonstrated that participants perceived a higher sense of self-efficacy in learning ethical dilemmas through the AR lesson, therefore they further suggested how AR can be implemented in classroom settings.

a. Participants suggestions other leadership skills that AR lessons can teach.

The following list illustrates participants' suggestions on potential leadership skills that AR lessons can teach. The bold fonts highlight the topics.

- I think for me, for my profession. The biggest thing would be I would like to see something that probably aligns with like relations, that **relationship building component**. You know, especially now that we aren't able to be face to face. So, having some way in which leaders are able to, I guess, create that boundary, because typically relationships, you know, were built when we're around each other, in front of each other. So, I would like to see how that will play out… If you're a school leader, would be that with teachers or like in my position I'm support so, I have to create the relationship with the principal and with the teachers, but also with the, you know the community around the school and everything. And so maybe having some type of application to create the type of interfacing where it's not just chat, but it's more meaningful. For example, having something that hosts some type of augmented event where you are actually working together through whatever problem it is we're trying to solve to help the school or the greater community (Participant 1).

- **Collaboration with other leaders** and let's see what I think collaboration with other leaders would be a great topic (Participant 13).
- I would like to learn more about … how to get **equity** in my classroom for all students not just race, not just racial or ethnicity, but equity for like my IP students and my ELL students to be able to use this technology to reach them and better ways because what I see this happening is learning how to differentiate those assignments for students who might need something more. So, if we could use this app in ways to like, they can have it. The same all the same information, but maybe one of them is in Vietnamese or one of them is reading the same information in their home language as well and able to have that conversation and make those connections in the classroom (Participant 7).
- You know, I think there could be able, a lot of practical things that could be used during that. Definitely you could use it for **professional learning communities** within your school district where different, maybe different subjects are discussed among your staff and then there's, they can go to a different link and all of them solve a different problem. And then probably come back to the staff as a general informational setting to show what everybody did as far as the problem and the solution they came up with and you know, probably, ultimately, you could help. And I'm just brainstorming here, but with goals missions and goals of school systems. You know, the initiatives each individual school that they're doing and possible outcomes that could have with that, as well. And be a great day to resource, I mean and again when they come back, they're able to show the information that's come up from their solutions…You know, a great thing probably would be just simple things like going over the **teacher handbook** or because a lot of times what I've started doing because I've had such a large turn over the last two or three years is I have all new employees to the district come in for, you know, and a new employee orientation and that would handle a lot of the situations that would be able to do in a faster way that they would probably be able to recall because a lot of times I have

to go back and say, you remember when we talked about this and they're looking at me with a blank look on their face because nothing's worth for a new person to come in and be inundated with all this information and it's lost somewhere but it you know if they could go back even recall the tool when to use the tool over that might be a great, great way to use that (Participant 10).

- I think it would still be **decision making** at the, you know, in the class that I'm taking now with Dr. Curry. It's really teaching us that you know this. How many ethical decisions that we have to make, some of them are congruent with your five foundational beliefs and some of them aren't. So, continuing to learn the art of making ethical decisions. Other side of making ethical decisions (Participant 17).
- Ethical dilemmas are probably the biggest one, but even like **cultural diversity** to learn how different cultures handle situations. Even situations that I may not think of [in the] beginning that's running through their minds and will help me think of culturally based on what they would do in their culture, compared to maybe what I do (Participant 4).
- I think that it would be good for, because I'm in health. It wouldn't be necessarily ethical dilemmas, but it could be because I'm in health and our students. We do a lot of case studies. So, we present a lot of case studies where they have to choose the best route of **treatment** or choose, you know, what the next step would be for that patient. So, in that aspect of it, it will be useful for just general cases (Participant 5).
- I definitely think it could be valuable with about like **supervising instruction and related to teacher evaluations** to be able to watch a, like a sample of a teacher teaching and then make, okay based on what you saw. What's, what, what did you observe and how would you, I don't want to say score, but I mean evaluations are scores. So, would that be applying. Would that be developing. Would that be innovating and kind of get

practice that conducting teacher evaluation prior to actually doing an evaluation (Participant 9).

- I think it can be used in learning about myself as a leader. I think it can be used to learn more about my own **leadership style**. Um, I think it could be used to help me identify what my **strengths and weaknesses** are, as the leader (Participant 14).
- I feel good about it like school operations. I feel good about classroom management rules more [than] I feel pretty good about. Sorry, I feel pretty good about managing people teachers. What I think I will struggle with the most is **how to interact with the cultures and communities**. Within my school district, whatever. If I like let's say, I go somewhere new to me and I'm principal there. How am I going to address my communities? All the people in my community. How am I going to make that connection between school and community, cultures, peoples, businesses, industry? How am I going to do that? I don't know. I don't know if there's application for the augmented reality in that or not, but probably your case studies scenarios (Participant 1).
- **Conflict resolution**, I think would probably be a good one. Whether with staffer [or] with students or with parents all three (Participant 15).
- I wish we had more training on delegation that probably comes from, like, **trust**, maybe...But, you know, to develop a team around you. So maybe that falls a little bit more like organizational building or team building but. And then the other thing just personally that I feel would change my ability to be effective as a leader...I wish that we had storytelling as part of the curriculum or as lessons because not everyone is charismatic and not everyone you know can deliver something in a narrative...So, I wish that there was a way to learn more about how to take our personal experiences or pivotal moments in our life and turn them into almost like, just like conversational...I wish there was a way to learn how to communicate in that style when you're not able to have two-

way interaction, because I feel like conversation is good because when you have feedback. But if you are given a webinar...you don't get that engagement back from the listener or the learner...And so, I wish there was a storytelling component that could be learned. (Participant 12).

- Um, I think it would be kind of interesting to like see the different leadership skills, like the **different kinds of leadership aspects** and kind of see like okay so. This is what I'm trying to think of one off the top of my head, I'm sorry. (laugh) This is what transitional leadership looks like. And this is what authentic leadership looks like and kind of so you could like interact with that kind of a leader to kind of see, you know, oh, I understand what that's like. Now, instead of just reading about it (Participant 3).

b. Participants suggested how to apply AR in their Professions.

In addition to using AR in teaching leadership skills, participants suggested implementing AR in their professions and teach various subjects such as ethics, healthcare, special education, social emotional learning, and parent teacher conferences. The following list demonstrates direct quotations from participants' suggestions. The bold fonts highlight the subjects.

- I actually wish that we would have it more, you know, I think it would be a great tool for not just students to use but teachers and professors. I'm especially like if you're doing case studies or any type of collaborative work (Participant 1).
- Well, it was a really cool thing. I would like to be able to somehow use that with my students, although it might be a little challenging, but you never know if I introduced that, there may be some sort of processing that they can do that normally they wouldn't be able to do so, I really want to try to introduce it somehow to some of my higher functioning students to see if they can understand the content better than, you know, the old fashioned way of just teaching (Participant 11).

- I think it's something that I could use in my classroom even because it was simple (Participant 7).
- I think I can use it as a teacher, I can teach students about **ethical dilemmas and choices**. They're going to have to make through life. And then as a leader in my building. I can also give teachers and other staff members decisions they're going to have to make eventually on their own to give them ideas of what their choices could be… I think this app can be used in History too… In history, right now that we're getting finished the American Revolution, so we can talk about the reasonings to go into or not go into war and kind of see the ethical dilemmas they're going to have if they choose to go and war (Participant 4).
- I think It'd be useful for students definitely… like we are dealing with right now umm **treatment of someone with special needs or a medically compromised.** So, if there was a case study about a patient coming in that had these health conditions or had these disabilities. It can be a case where they're deciding how, what do I need to go through to get my operation ready. What do I need to do in place for this and I mean for this patient that I wouldn't do for anybody else? What thing am I gonna have to change to provide treatment for this patient? (Participant 5)
- I think it'd be really interesting to see it implemented in more and more graduate classes and even in undergrad classes, thinking back to when I was an undergrad student and I think that could have been a really cool tool that could have been used… I feel like the AR technology would be a really cool tool because a lot of education, College of Education programs at the undergrad level only have one class on **special ed**. And so, allowing students to think about, you know, how they. This is a student struggling. How would you provide accommodations and or how would you adjust your teaching to meet the needs of the students? I think that could be super beneficial and helping general

education teachers feel more comfortable working with students with disabilities. (Participant 9).

- I can see the application to students. So, in my program. I teach **social emotional education soft skills**. So, how students should behave, how students should deal with their emotions how students should treat other people and other students. Having empathy, having self-confidence, having positive self-images. Speaking in public, you know, lots of different things that go along with being good social and emotional adults. I think I could see a lot of application for the augmented reality app in that scenario, just like what you presented us with where you had to be presented with a scenario and decide what action you would take. I think you could do the same thing with students in subject matter that dealt with social issues, emotional issues, self-control, and confidence if you could present them with a scenario and then give them options. And then as they make those options they get feedback about this option isn't the best because or this option is bad because or this option is the best… I don't know what your plan is to do with it, but I think if you could develop some curriculum with it. I think you would have potentially have a marketable product. You can make money with it (Participant 1).
- I could see one thing that we have coming up is **parent teacher conferences**. And we like to give the teachers like role play scenario so they can practice talking about it. And this could be used for that scenario for teachers to practice (Participant 15).
- I think it was definitely a strong supplement. I think that because I was already familiar with the content beforehand, that it took away from being able to truly judge how much it helped me, but I think that it was a really good tool and I would not hesitate to use it, especially with like an earlier in their career, earlier in their education audience (Participant 12).

- Thank you for introducing it because I really do think I'm going to try to use something like that for my students, I think they would think that's awesome (Participant 3).

3.2. Improvement

This section answered the research question about participants' perceptions on the AR lesson. Even though participants expressed positive attitudes toward their experiences using the AR learning materials, some of them found difficulties in using the AR application. They faced technical difficulties such as poor internet connection and mobile device that failed to read the Zap code. The following list demonstrated participants' thoughts about the difficulties that they encountered.

- I would say the only difficulty I had was I'm not in a very good area for self-service and so it was a little slow because of my **connection** or reception to service. Because, and I can add a really didn't look at the time when we're doing that, but I am at my office and that my office, the Wi-Fi shuts off at seven O'clock and course class starts well after seven so I'm on another, I'm on a Wi-Fi, no personal hotspot majority of the time and not have to sit there at the window of my office because of the roof keeps the connectivity down a lot of times, so that was the only thing I was messing with was connect connection to Wi Fi (Participant 10).
- My difficulty was getting on because for whatever reason, my **phone wasn't reading the [Zap] code**… and that was a challenge for whatever reason, but that was the only difficult part of it… The only thing again. I enjoy. Once I was able to get me in. For whatever reason, I have an Android phone. I don't know if that was the reason why it was hard for me to read the [Zap] code. But that was the only challenge that I had… When I had to hover my phone over there, for whatever reason, it wasn't picking it up (Participant 17).

In addition, participants had some comments to improve the AR lesson. The following list demonstrated direct quotations from the participants' comments. These comments were coded as having more directions, more case studies, more questions, longer activity, and shorter video.

a. More Directions.

- I was just a little confused on what I was supposed to do next. So, make it out, like if there's a guide on there that tells you, okay, click this to move forward to the next thing, or click this to go back to the main screen. **I just really didn't know what to do once I answered the question** (Participant 5).
- The only thing that I thought was a little bit confusing was whenever we submitted our answers. **It was hard to tell, like if we were supposed to like go to the next page or if we were finished or like how to end.** Like what to do next. I think that was I think that was a little bit like it. It made sense. Eventually, but at first it was like, okay, so did I do the right and I choose the right thing? Did I push submit the right way. So just kind of like an ending like knowing. Okay, so I pushed this button. Okay, I'm good, that sort of thing (Participant 3).

b. More Case Studies.

- I felt like I probably would have had to use it more [case studies] to make a better decision like answering one question didn't allow me to use it as much. You know, so have the opportunity to use it a little more, but maybe having several questions would have been great just to kind of see to have something to compare it to…I feel like **[having more case studies] would allow someone to use the application in greater detail.** Maybe there were two dilemmas. There were two different studies for them to make decisions on (Participant 5).

c. More Questions.

- But I thought **it would be great to have like more questions to have to, you know, cycle through**. It would have been good. So, it would have been good to decide, you know, to have like the question like, who should come out? Who should they rescue first or in that example? or Were they decided to collaborate you know, with the other countries? and then give us a next step. Like, who, you know, which country best service for diverse … and then we have to choose that (Participant 1).

c. Longer AR Activity.

- **I actually thought [the AR activity] would be a little bit longer.** Or maybe that's just because I maybe I want it. You know, more like I know we discussed like the things that happened afterwards (Participant 1).

d. Shorter Video.

- I think that the way it was presented that for me as an individual learner. **The video was too long** because I usually like to learn by reading. And so, it's just based on my individual learning style. However, I think if we had been in a small group. Or if you'd said like three of us, you know, do that. And if there was especially the only one PDF, you know, or one paper, like small group table. Versus like everyone reading it and turning around, or someone reading that loud, that would have been extremely valuable and I liked how it was conversational because sometimes I think when people are just reading. If that's not their main style. They don't see it in the different voices. And so, I thought it was nice in the air. How had different characters for different perspectives, because I think that helps someone start to see things from a different point of view (Participant 12).

These suggestions for implementing and improving the AR lesson are helpful for a further development phase of the AR lesson. These suggestions are discussed in the following chapter on the implications of practice section.

CHAPTER V

DISCUSSIONS

This chapter presents a summary on findings of the participating preservice educational leaders' self-efficacy and perceived experiences in using AR technology in learning ethical dilemmas. These findings are interpreted and discussed through the theoretical frameworks including Bandura's self-efficacy theory and Mayer's cognitive theory of multimedia learning. In addition, this chapter presents the limitations of the study and posits suggestions for implications of practice and future research.

Summary

The aim of the study was to explore the impact of AR on preservice educational leaders' self-efficacy in learning how to solve ethical dilemmas. The research guiding questions were:

1. What is the influence of an AR application that provides rich media problem-solving experiences on preservice educational leaders' self-efficacy for addressing ethical dilemmas?
2. How do preservice educational leaders perceive the AR lessons and their effects on self-efficacy?
3. To what extent do the quantitative results on self-efficacy agree with the interview findings on preservice educational leaders' experiences with the AR app?

To answer the research questions, a mixed-methods approach was used to collect and analyze the data from pre- and post-surveys and follow-up interviews. Participants were preservice educational leaders who were graduate students in educational leadership classes. The study was able to answer the research question that an AR application influenced preservice educational leaders' self-efficacy in learning ethical dilemmas. The findings were interpreted and discussed regarding how AR impacted preservice educational leaders' self-efficacy and perceived experiences. Albert Bandura's theory of self-efficacy was used as a theoretical framework to guide how AR learning materials influenced preservice educational leaders' self-efficacy. In addition, Richard Mayer's cognitive theory of multimedia learning was used as a lens to guide how the AR multimedia instruction provided authentic problem-solving experiences. The results indicated that the AR application did not influence authentic problem-solving experiences on participants' self-efficacy for addressing ethical dilemmas. Even though the inferential statistics (Table 4.1) showed that participants had higher means of ethical dilemmas' self-efficacy levels after performing the AR exercise, the difference was not significant.

From the interview findings, participants expressed positive perceptions that the AR lesson was enjoyable, user friendly, engaging, interesting, and attention-grabbing. The AR lesson's influence was an increase in participants' self-efficacy by providing guidance, choice, ability to make decisions, engagement, virtually process, and remembrance. Additionally, participants suggested ways to implement AR in learning other leadership skills including relationship building, collaboration, equity, diversity, decision making, teacher orientation, teacher evaluations, leadership styles, and conflict resolution. Besides using AR in learning leadership skills, participants recommended implementing it in their teaching in various areas such as ethics, history, healthcare, special education, social-emotional learning, and teacher development. Both assumptions showed that the quantitative results agreed with the interview findings on participants' experiences with the AR application in that it increased their self-efficacy for addressing ethical dilemmas.

Research Question 1

What is the influence of an AR application that provides authentic problem-solving experiences on preservice educational leaders' self-efficacy for addressing ethical dilemmas?

The quantitative results showed that participants' perspectives of self-efficacy in dealing with educational ethics did not increase after learning through AR materials. Even though the overall means between the pre and post surveys of participants' ethical dilemmas self-efficacy scales increased after they performed the AR exercise (Figure 4.1), the difference between pre and post self-efficacy scores was not significant. This means that the AR application that provided authentic problem-solving experiences did not influence preservice educational leaders' self-efficacy for addressing ethical dilemmas. From the quantitative results, participants agreed the AR application was effective and assisted them in learning ethical dilemmas. However, their confidence to learn to face ethical dilemmas has not grown as expected (Table 4.7). Their confidence levels in their overall knowledge regarding solving ethical dilemmas did not significantly increase (Table 4.6). This might be because the AR exercise that they participated in had only one case study. Therefore, they did not gain overall knowledge in solving ethical dilemmas through only one case study activity. The next reason might be because of the design of the AR application. Some participants suggested improving the AR lesson by having clearer directions of steps that they needed to complete. In addition, the small sample size may have made it difficult to measure significant differences.

According to Bandura (1990), the four sources that promote human's belief in self perceived efficacy are (1) *mastery experiences*, (2) *modeling*, (3) *social persuasion*, and (4) *physiological status*. The AR lesson provided participants an experience in solving ethical dilemmas. It offered them a case study video, a question, and three choices of actions to take. Additionally, the AR lesson modeled for participants how the leadership characters made a decision and took an action successfully. The AR lesson also provided social persuasion and

physiological status. Participants reported feeling immersed in the scenario when they viewed the case study videos. In addition, they felt confident whenever the interactive feedback feature in the AR application affirmed they made the correct choice. The AR lesson met these four sources of self-efficacy conditions. However, one AR case study exercise might not be enough for participating preservice educational leaders to gain mastery experiences. Therefore, participants' self-efficacy levels in dealing with educational ethics between before and after the AR exercise were not significantly different. Future studies of longer duration would be valuable.

Research Question 2

How do preservice educational leaders perceive the AR lessons and their effects on self-efficacy?

Although the quantitative findings did not show a measurable change in self-efficacy, coding from the interviews revealed that participating preservice educational leaders perceived that the AR lesson affected their self-efficacy by offering them modeling, choice, decision-making, visual processing, and encoding to memory.

1. Modeling

The AR lesson provided possible actions and consequences that demonstrated what to do and what the outcomes would be. This kind of exercise provided participants with a model of how to deal with ethical dilemmas. As mentioned above, modeling is an important facilitator of self-efficacy (Bandura, 1997b). The data verified the work of Bandura by showing that participants perceived self-efficacy after completing the AR exercise because they could see leadership models from the case study videos. The AR lesson helped build the participants' confidence by modeling ways to take action from three potential choices and see possible outcomes. According to Bandura (1997a), "Seeing or visualizing people similar to oneself perform successfully typically raises efficacy beliefs in observes that they themselves possess the capabilities to master comparative activities" (p. 87). Comments from participants in interviews

suggest that when they saw characters in leadership positions in the case study perform successfully, they began to imagine themselves performing successfully as well.

2. Choice

The AR lesson offered participants a case study video, a question, and three choices of actions to take. Once participants selected a choice, it presented a consequence video, revealing an answer reflecting their decision making. Therefore, participants were able see a possible outcome of their decision. If they made poor choices, they could see possible issues they might face. Choices enabled participants to create beneficial actions and operate control over them. By selecting choices, they could exercise control over their actions and see potential outcomes of their decision-making. This selection process could improve self-efficacy beliefs in accomplishing the exercise of solving ethical dilemmas. As Participant 4 stated, "Yes, I do [feel increased confidence]… I mean, [the AR application] gave me my choices. It helped pick what I thought was best and it kind of gave me why [the leadership team] chose that and why it ended up being the best for the situation." To put it another way, the AR application assisted her to become more confident in learning ethical dilemmas by providing choices of actions. It also offered her a reason for choosing the best decision. Having the opportunity to make choices through an interactive feature on the AR application enabled participants to easily access the relevant information and enhanced the effectiveness of decision-making (Shaw, Chen, Harris, & Huang, 2009). According to Bandura (1997a), "People are partly the products of their environment. By selecting their environment, people can have a hand in what they become. Choices are influenced by beliefs of personal capabilities" (p. 160). The data confirmed the work of Bandura (1997a) by showing that some participants said the opportunity to make choices made them feel more confident.

3. Decision-Making

Participants stated that they appreciated the ability to make decisions and solve problems. Some participants stated that they could face situations with ethical dilemmas without fear and

practice decision-making, which prepared them to face challenging tasks and improved their decision-making capabilities. They could master their experiences in solving ethical dilemmas. Bandura (1997b) states, "The most effective way of creating a strong sense of efficacy is through *mastery experiences*. They provide the most authentic evidence of whether one can muster whatever it takes to succeed" (p. 3). The findings supported the work of Bandura's self-efficacy theory by showing that the AR lesson offered decision-making exercises for participants to gain experience in solving ethical dilemmas. Participant 15 explained how the AR lesson encouraged participants to be more confident, "it helped you become more confident that you were choosing the right thing. So, when in real time you have something you could be more confident because you kind of practice." This means that the AR lesson enabled participants to practice and gain mastery experiences in solving ethical dilemmas.

In Bandura (1997b)'s view, developing a resilient sense of perceived efficacy involves experience with perseverant effort that overcomes obstacles. In the same way, the AR lesson offered experiences where participants could practice regardless of facing failure or success. If participants made a wrong decision, they could see a reason and consequence of making an incorrect decision. Then, they could reselect other options and finally make a correct decision. As Participant 17 stated,

> I was doing it on my own and doing it on your own is what helped build confidence. You can fail in front of no one but yourself and then figure it out by, you know, going back through it or doing whatever you need to do and how you learn best. You had that opportunity (Participant 17).

Autonomy in decision-making enabled participants to practice and gain experiences in dealing with ethical dilemmas. This kind of practice – making decisions and experiencing success or failure – could be a factor to promote self-efficacy based on Bandura's *mastering experiences* factor.

4. Visual and Verbal Processing

Participants viewed the AR lesson positively as it enabled them to process knowledge visually and verbally. They could view case study videos through a mobile application screen, which contained animated characters, and listen to voice overs, sound effects, and background music. In addition, they could see both virtual content on a mobile screen over a text-based case study on a physical worksheet. The findings are consistent with Mayer (2001) cognitive theory of multimedia learning by shedding insight on how participants successfully learned with the AR lesson. According to Mayer (2001), for participants to have meaningful learning in a multimedia environment, they must engage in these five cognitive processes: (1) select spoken words for processing in verbal working memory, (2) select pictures for processing in visual working memory, (3) organize spoken words into a verbal mental model, (4) organize pictures into a visual mental model, and (5) integrate verbal and visual representations. These processes do not have to be in order. The findings support Mayer (2001) five steps in a cognitive theory of multimedia learning by showing that the AR lesson enabled participants to see and listen to case study animated videos so that they could cognitively process knowledge, which is involved in active learning (Mayer, 2001).

Mayer (2001)'s third assumption, called *active processing*, states that meaningful learning occurs when students select relevant information, organize it into meaningful representations, and associate it with existing knowledge. Active learning takes place when "a learner applies cognitive processes to incoming material – processes that are intended to help the learner make sense of the material" (Mayer, 1997, p. 68). Multimedia instructions help students maintain their interest and engage in learning activities. When a learner tries to understand a multimedia message, knowledge is constructed. In this study, active learning was established by participants paying attention to the case study multimedia materials, organizing them into a cause and effect sequence, and integrating them to existing knowledge about educational ethics. The findings also supported the work of Mayer (1997) by demonstrating that multimedia instructions

enhanced students' understanding of complex contents. Consider how one participant understood the ethical dilemma case study, for example.

> The way that I process when I was doing that lesson when we were talking and going through that. Like I said, I really feel like… I was understanding it, but it was in a different way than if I was just reading the material. So, if that can happen with our students. That's a really amazing tool to be able to use for students even me as a student to understand things much more in depth (Participant 11).

The findings also verified extant research (Green et al., 2019; Hsu et al., 2017; Vallera, 2019) by showing that AR promoted authentic case studies and enhanced storytelling. AR technology enhanced digital telling story by embedding case study videos and interactive content that engaged participants to learn ethical dilemmas with an immersive learning experience. In this study, participants felt that they were in the case study situation and engaged in learning. Participant 13 stated,

> I thought that was just to bring something to life for the story to be read aloud and then presented in a real time, real life kind of situation was really cool. I really enjoyed that. It just brought the story to life more and more where I could understand [and] comprehend what was going on. And they're really engaged with what the story was about (Participant 13).

Visual and verbal processing from multimedia instructions influenced participants' self-efficacy by engaging them in active learning and enhancing an understanding of the ethical dilemmas content.

5. Encoding to Memory

Participants reported that the animated videos and interactive feedback features of the case studies helped them remember what they had seen and experienced in the AR lesson. As Participant 1 stated:

> I think it would make a place in my brain where they would actually stay and cut in and be able for me to remember whenever I'm a principal and I come across some kind of ethical dilemma and my brain accesses that time that I use augmented reality in this case study. I know for me, it would be more likely for me to remember something I've seen and experienced in augmented reality than it would be something I read without a doubt (Participant 1).

Rich media in the AR lesson assisted participants with the process of encoding to long-term memory. The AR lesson contained multimedia and interactive elements such as graphics, audios, animated videos, plain texts, and hyperlinks. These components are considered as high information richness in Daft and Lengel (1983) as they contained the characteristics of immediate feedback, visual and audio channels, and body and natural languages (Daft & Lengel, 1983; Shaw et al., 2009). The hypermedia technology – that combines text, multimedia, and links – allows users to easily access the information to enhance their understanding. It enables users to interact with the information and receive instant feedback. Hypermedia learners are more likely to understand the information deeply and process it cognitively (Shaw et al., 2009). Rich information has a high potential carrying capacity of data and provides new solid understanding (Daft & Lengel, 1983). According to Kellermann (1985), media affects encoding in long-term memory by the main two factors: *attention* and *parsing*. In the study, participants paid attention to the AR lesson and then processed understanding and problem-solving. In addition, they parsed or organized the information into pattern units or chunks. Therefore, participants would be able to remember things they have seen and encoded in a long-term memory.

Research Question 3

To what extent do the quantitative results on self-efficacy agree with the interview findings on preservice educational leaders' experiences with the AR app?

The quantitative results did not agree with the interview findings on preservice educational leaders' experiences with the AR application. The quantitative results showed that participating preservice educational leaders' self-efficacy did not significantly increase after they completed the AR exercise. In contrast, the interview findings demonstrated that some participants perceived a higher sense of self-efficacy in learning ethical dilemmas. The interview findings revealed that ten participants discussed a higher sense of self-efficacy in learning ethical dilemmas, but four participants did not see any influence of the AR lesson on their self-efficacy. One of the reported reasons that AR materials did not increase the participants' self-efficacy was that the participants already had high levels of previous administrative experience. For example, Participant 10 explained that he had 23 years of experience in an administrative role, so he was already confident in handling ethical dilemmas before completing the case study. He also had a professional network he could trust and consult with when he encountered challenging situations. Based on Bandura (1997b), the highest source of self-efficacy is *mastery experiences*. Since some participants already had mastery experiences in dealing with ethical dilemmas, they most likely already had high levels of self-efficacy so there was not much room for significant change. Another possible reason was that a participant may lack familiarity with using technology and need more experience using it. A lack of self-efficacy with technology might make it difficult to learn from the AR lesson.

The difference between quantitative results and qualitative findings can often lead to an enriched explanation (Todd, 1979). Qualitative findings can highlight areas of difference that generate a deeper understanding (Tonkin-Crine et al., 2016). In this study, the quantitative method produced results which did not confirm the prediction. However, follow-up interviews – suggested there might still be potential for the AR lesson to influence preservice educational

leaders' self-efficacy. This interpretation resulted from the divergent findings based on surveys and open-ended interviews. The interview data revealed participants' perceptions of how the AR lesson influenced their self-efficacy, even though survey results indicated that there was no significant difference of participants' self-efficacy between before and after intervention. The qualitative data complements the quantitative findings and support future research (Todd, 1979).

Learners' subjective perceptions might be really important to instructors or instructional designers even if the objective evidence of improved learning is not there. Their perceptions could be significant because they demonstrated why some of the participants did not agree that the AR lesson influenced their self-efficacy. Even though the quantitative result did not show a significant impact of the AR lesson on participants' self-efficacy, the result showed that participants had a higher mean in ethical dilemmas' self-efficacy levels after performing the AR exercise. Interview findings revealed that the AR lesson provided participants with modeling, choice, decision-making, cognitive processing, and coding to memory. In addition, participants had significant higher self-efficacy in using AR after completing the exercise. Both quantitative results and qualitative findings agreed that the AR application was easy to use.

Limitations

The limitations of this study were that it had a small number of participants and the data collection process occurred during the COVID-19 pandemic. Firstly, the number of participating preservice educational leaders who were students in the *Leadership Theory and Ethical Decision Making* and *School Leadership, Culture and Ethics* classes were 17. This number might be small to produce statistical power in quantitative research. However, fourteen of them participated in follow-up interviews. The researcher was able to collect rich data from individual interviews.

Additionally, classes were held online during the COVID-19 pandemic. Instructions had to change from face-to-face to online format and follow the institution's COVID plan and guidelines. Participants who were students in educational leadership classes had to attend the

class online through Zoom. The original plan was to hand out worksheets in the class. However, the plan was changed from face-to-face to online class. Participants had to open a PDF worksheet on their computer, instead of a physical worksheet. Additionally, the researcher could not assist participants face-to-face. This could be challenging for participants who needed help because they could not clearly show their application screen and get help right away. In addition, the researcher could not observe participants thoroughly because the Zoom screen only showed their faces, and not what appeared on the application screen. However, Zoom's functions greatly helped the researcher communicate to participants and collect data safely.

Besides limitations due to COVID-19, the duration of this AR intervention was short. Participants used the AR learning materials within one class period. They experienced using an AR application for around 30 minutes. The survey data collection took place before and right after participants participated in the AR exercise. Therefore, this short intervention might not contribute a significant impact between before and after AR exercise.

Implications of Practice

Based on the findings, participants suggested ways to implement AR in learning educational leadership skills. AR can be applied in learning skills such as relationship building components, collaboration with other leaders, equity in classrooms for all students, important decision making, new employee orientation, cultural diversity, ethical dilemmas for treatment, supervising instruction, teacher evaluations, leadership styles, conflict resolution, team building, and more. In addition, participants expressed their interests in applying AR lessons in classrooms. They thought the technology would help teach lessons. For example, AR can be used for teaching ethical dilemmas and choices, class subjects such as history, treatment of someone with special needs or a medical condition, special education, social-emotional education, and parent teacher conferences. Using AR to teach subjects at different educational levels could be a beneficial reason for teachers to implement AR in their classrooms.

Furthermore, participants suggested ways to improve the AR lesson. For example, providing clearer directions, more questions, longer activity, and shorter case study videos. These improvements can be considered in future development of AR lessons. For example, the instruction designer can consider adding a tutorial demonstrating how to use an AR application and state a clear step-by-step direction of what to do after completing each task. The class instructor can consider adding several questions regarding the case study to ensure that preservice educational leaders make appropriate decisions in detail. The instructor can consider making AR activity longer so that preservice educational leaders can fully participate in the lesson and discuss it with classmates. The instructional designer can consider shortening the case study videos to appropriate lengths such as 30 seconds for a short video or up to 3 minutes for a long video. The instructional designer can consider adding important information at the beginning of the video.

Suggestions for Future Research

The findings of this study have various implications for future research. This section recommends future research in the following area: (1) exploration of larger sample size of the study; (2) investigation of more analyses; (3) use of the improved AR lesson in educational ethics classrooms; (4) the relationship between preservice educational leaders' self-efficacy in learning other educational leadership skills; and (5) exploration of the enjoyment of AR lessons in learning ethical dilemmas.

According to the limitations of this study, future research can include larger sample sizes and more analyses. This can be done by recruiting a sample from more educational ethics course sections or from other institutions. Based on the limit timeline of data analysis, the researcher can gather data in various timelines throughout the semester to see if there is any significant difference between participants who use an AR application at the beginning, middle, and the end of the semester. The instructor can consider adding more AR lessons and case studies for

participants to learn from and practice decision making regularly throughout the semester. Future research can investigate whether participants gain more practice with several AR case scenarios, and if their self-efficacy levels will change or not.

Additionally, based on participants' suggestions for improving the AR lesson, future research can explore how the suggested improvements make a difference in participants' self-efficacy in addressing ethical dilemmas. For example, how adding clearer directions, more questions, longer activity, or shorter videos can make any difference on participants' self-efficacy levels. Moreover, participants suggested applying AR in learning other educational leadership skills. Future research can explore how AR influences preservice educational leaders' self-efficacy in learning other skills. Finally, based on participants' common perspectives on the AR lesson, they enjoyed the AR exercise. Future research can investigate how AR influences preservice educational leaders' enjoyment in learning ethical dilemmas.

Conclusion

This study explored the impact of augmented reality on preservice educational leaders' self-efficacy in learning ethical dilemmas. The guiding research questions were: What is the influence of an AR application that provides authentic problem-solving experiences on preservice educational leaders' self-efficacy for addressing ethical dilemmas? How do preservice educational leaders perceive the AR lessons and their effects on self-efficacy? and to what extent do the quantitative results on self-efficacy agree with the interview findings on preservice educational leaders' experiences with the AR application? A mixed-methods approach was used to explore the data. The quantitative results presented that the AR lesson did not influence participating preservice educational leaders' self-efficacy in learning by providing authentic problem-solving experiences. However, the interview findings demonstrated that some participating preservice educational leaders increased self-efficacy when learning ethical dilemmas with the AR lesson. The factors that impacted their self-efficacy are modeling, choice,

ability to make decisions, visual and verbal processing, and encoding to memory. Furthermore, they expressed their enjoyment and engagement in learning. They would use AR instructional materials for learning and teaching other subjects. Further research would continue regarding the dissonance of perceived self-efficacy between the quantitative and qualitative data. Future research should explore the relationship between participants' self-efficacy in learning other educational leadership skills and the enjoyment of using AR when learning ethical dilemmas.

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APPENDICES

APPENDIX A: APPLROVAL OF EXEMPT IRB APPLICATION

Approval of Exempt IRB Application IRB-20-306

IRB Office <irb@okstate.edu>
Wed 7/1/2020 11:13 AM

To: Chaivisit, Yam <yam.chaivisit@okstate.edu>; Thompson, Penny <penny.thompson@okstate.edu>; Chaivisit, Yam <yam.chaivisit@okstate.edu>

Dear Yam Chaivisit,

The Oklahoma State University Institutional Review Board (IRB) has approved the following application:

Application Number: IRB-20-306
PI: Yam Chaivisit
Title: The Impact of Augmented Reality on Preservice Educational Leaders' Self-Efficacy
Review Level: Exempt

You will find a copy of your Approval Letter in IRBManager. Click IRB - Initial Submission to go directly to the event page. Please click attachments in the upper left of the screen. The approval letter is under "Generated Docs." Stamped recruitment and consent documents can also be found in this location under "Attachments". Only the approved versions of these documents may be used during the conduct of your research.

As Principal Investigator, it is your responsibility to do the following:

- Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted for IRB approval before implementation.
- Submit a request for continuation if the study extends beyond the approval period.
- Report any adverse events to the IRB Chair within 5 days. Adverse events are those which are unanticipated and impact the subjects during the course of the research; and
- Notify the IRB office when your research project is complete by submitting a closure form via IRBManager.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact the IRB office at 405-744-3377 or irb@okstate.edu.

Best of luck with your research,

Sincerely,

Dawnett Watkins, CIP
Whitney McAllister, MS

Oklahoma State University
Institutional Review Board
Office of University Research Compliance

APPENDIX B: RECRUIT PARTICIPANTS FORM

Recruit Participants

Sending email address: yam.chaivisit@okstate.edu
Subject: Invitation to Participating in a Dissertation Study

Dear Students,

I am Sarinporn "Yam" Chaivisit. I am a doctoral candidate at Oklahoma State University. I kindly invite you to participate in my dissertation study that I am conducting titled **The Impact of Augmented Reality on Preservice Educational Leaders' Self-efficacy**. The purpose of this study is to explore the ways in which Augmented Reality (AR) learning materials help to make case studies richer or more authentic so that preservice educational leaders can prepare for increasing self-efficacy in learning education ethics and law.

Participation is completely voluntary and you may withdraw from the study at any time. The data is anonymous and protected.

Participation in this study requires you to have a mobile device (such as a smartphone or a tablet), an internet web browser, and the Zoom application. You will be surveyed regarding your experience of using the AR app to learn through online pre- and post- surveys. Please follow the step below:

1. Read a consent form on https://okstatecoe.az1.qualtrics.com/jfe/form/SV_dd6HA0L1KRPTuiV.
2. If you agree to participate in the study, you will click on the NEXT button and complete a pre-survey of opinions.
3. Download the attached PDF worksheet.
4. Download and open the Zappar app.
5. Use the Zappar app to scan a zap code provided on the worksheet.
6. View a case scenario video on a mobile screen.
7. Click on an appropriate choice to answer the question on a mobile screen.
8. Please repeat steps #3 to #5 on the attached worksheet pages 2 and 3.
9. After you finish exploring the AR learning materials, please take a post-survey on your opinions about your experience using the AR app on https://okstatecoe.az1.qualtrics.com/jfe/form/SV_6KEqr2fcxuLidfL.

Afterward, if you are interested in participating further, I will contact you for a further optional Zoom interview on how to improve the AR learning materials. The whole process will take around 30 minutes to 1 hour.

You will receive a $15 Amazon gift card as a thank you gift for your participation ($5 for completing opinion surveys and $10 for participating in the qualitative part of the research). This study will be beneficial for preservice educational leaders, educators, and instructional designers interested in implementing AR in educational settings.

If you have any questions, please email me, Sarinporn "Yam" Chaivisit, at yam.chaivisit@okstate.edu or my advisor, Dr. Penny Thompson, at penny.thompson@okstate.edu or call her at (405) 744-8042.

Thank you very much for your time and participation.

Sincerely,
Sarinporn "Yam" Chaivisit (Doctoral Candidate, Oklahoma State University)

Approved: 07/01/2020
Protocol #: IRB-20-306

COLLEGE OF
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ADULT CONSENT FORM
OKLAHOMA STATE UNIVERSITY

PROJECT: The Impact of Augmented Reality on Preservice Educational Leaders' Self-Efficacy

INVESTIGATORS:
Sarinporn “Yam” Chaivisit, Ph.D. Candidate, Oklahoma State University
Penny Thompson, Associate Professor, Oklahoma State University

PURPOSE:
The purpose of the study is to explore the ways in which AR learning materials help to make case studies richer or more authentic so that preservice educational leaders can prepare for increasing self-efficacy in learning educational ethics and law.

PROCEDURES:
Survey
1. Click on the "Next" button if you agree to participate in this study.
2. Take a pre-survey.
3. Install the Zappar app on your mobile device (if you don't already have it).
4. Use the app to scan an AR code on the given handout and explore the AR learning materials.
5. Take a post-survey. At the end of a survey, you will also have the

Approved: 07/01/2020
Protocol #: IRB-20-306

option to provide your contact information if you are willing to be contacted for a follow-up interview through Zoom or in-person. If you agree to be interviewed, the researcher will email you and schedule an interview.

Observations and Assignment Sharing

The researcher will observe class activities. Video and images will be recorded during class activities. In addition, the researcher will look at the products you produce in the course. You will be asked to share your assignments with the researcher. These observations and assignment sharing are optional. Below, you will be asked to consent to these procedures individually, allowing you to consent in part or as a whole based on your comfort level.

RISKS OF PARTICIPATION:

There are no known risks associated with this project which are greater than those ordinarily encountered in daily life. In an optional in-person study platform, CDC social distancing will be applied. The researcher will provide masks, gloves, and hand sanitizer to you. If you prefer an in-person interview, you will be interviewed individually rather than as a group. The meeting will take place in a large room that allows for physical distancing. The researcher will be 6 feet away during the interview. The researcher will sanitize the meeting space and after each interview. In addition, the researcher will allow a minimum of three hours between each interview. You will be asked whether you have a cough, fever, or any other COVID 19 symptoms. The researcher will stay physically distant. For example, if you are not using your own device and the researcher is providing some from the lab (which will be sanitized), the researcher will lay them on a table and then step back and let you pick them up.

BENEFITS OF PARTICIPATION:
There are no direct benefits to participating in this study. If you are interested, we will send you a copy of the results of the study when it is finished.

CONFIDENTIALITY:
Your information will be kept confidential. You will be assigned an ID number at the beginning of the study, and that number will be used to identify and match your questionnaire responses. Your name will not be stored with the other information we collect.

COMPENSATION:
You will be compensated for your participation. Once you complete the opinion surveys, you will receive a $5 Amazon gift card. If you agree to be interviewed, you will be offered an additional $10 gift card for the 10-15 minutes interview.

CONTACTS:
You may contact any of the researchers at the following addresses and phone numbers, should you desire to discuss your participation in the study and/or request information about the results of the study: Sarinporn “Yam” Chaivisit, Ph.D. Candidate, at 303 Willard Hall, Educational Technology program, Oklahoma State University, Stillwater, OK 74078, or Penny Thompson, Assistant Professor of Educational Technology, 201 Willard Hall, Oklahoma State University, Stillwater, OK 75078, (405) 744-8042, penny.thompson@okstate.edu. If you have questions about your rights as a research volunteer, you may contact the IRB Office at 223 Scott Hall, Stillwater, OK 74078, 405-744-3377 or irb@okstate.edu

Approved: 07/01/2020
Protocol #: IRB-20-306

PARTICIPANT RIGHTS:

I understand that my participation is voluntary, that there is no penalty for refusal to participate, and that I am free to withdraw my consent and participation in this project at any time, without penalty.

If you choose to participate: Please, click NEXT if you choose to participate. By clicking NEXT, you are indicating that you freely and voluntarily and agree to participate in this study and you also acknowledge that you are at least 18 years of age.

Please check below to indicate your permission to include the following:

- [ ] I consent to let the researcher observe during the class activities.
- [ ] I am willing to share my class assignments with the researcher.

NEXT

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Protocol #: IRB-20-306

APPENDIX D: PRE-SURVEY

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ID

Gender

- Male
- Female
- Non-binary
- Prefer not to answer

Age

- 18 - 24 years old
- 25 - 34 years old
- 35 - 44 years old
- 45 - 54 years old
- 55 - 64 years old
- 65 years and older
- Prefer not to answer

Computer Knowledge Level

- ○ Beginner
- ○ Intermediate
- ○ Expert
- ○ Prefer not to answer

Have your ever used AR applications before?

- ○ Definitely yes
- ○ Probably yes
- ○ Not sure
- ○ Probably not
- ○ Definitely not
- ○ Prefer not to answer

Have you ever solved ethical dilemmas before?

- ○ Definitely yes
- ○ Probably yes
- ○ Might or might not
- ○ Probably not
- ○ Definitely not
- ○ Prefer not to answer

How many years have you worked as a school administrator? If you have

not yet worked as a school administrator or if you have less than one year of experience, please answer "0".

→

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Ethical Dilemmas Pre-Survey

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I feel this AR learning activity will provide me with a strong knowledge-base for solving ethical dilemmas.	○	○	○	○	○
I feel very confident in my overall knowledge regarding solving ethical dilemmas.	○	○	○	○	○
I feel very confident in my ability to solve ethical dilemmas.	○	○	○	○	○
I feel very confident in my ability to handle difficult ethical dilemmas.	○	○	○	○	○
I feel this activity					

will enhance my ability to face ethical dilemmas.	○	○	○	○	○
I can make sound decisions and am able to explain them based on professional, ethical and legal principles.	○	○	○	○	○
I am confident in my ability to understand and evaluate education research that is related to programs and issues in my (future) school.	○	○	○	○	○
I can explain to staff and parents the decision-making process of my (future) school district.	○	○	○	○	○
I can make decisions within the boundaries of ethical and legal principles.	○	○	○	○	○
I am able to explain the role of law and politics in shaping the school community.	○	○	●	○	○

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AR App Pre-Survey

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I anticipate that it will be easy for me to use the AR app.	○	○	○	○	○
I anticipate that I will have the capability to use the AR app.	○	○	○	○	○
I anticipate that I will be able to use the AR app without much effort.	○	○	○	○	○
I anticipate that the AR app will assist me in learning ethical dilemmas.	○	○	○	○	○
I anticipate that the AR app will be effective in learning ethical dilemmas.	○	○	○	○	○

When using the app, my confidence to learn to face ethical dilemmas will be more likely to increase.	○	○	○	○	○
While using the app, I anticipate that there will be no one around to tell me what to do as I go.	○	○	○	○	○
I anticipate that someone else will help me get started using the app.	○	○	○	○	○
I had never used a technology like AR before.	○	○	○	○	○

→

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Part 1 - Ethical Dilemmas

ID

Ethical Dilemmas Post-Survey

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I feel this AR learning activity provided me with a strong knowledge-based for solving ethical dilemmas.	○	○	○	○	○
I feel very confident in my overall knowledge regarding solving ethical dilemmas.	○	○	○	○	○

I feel very confident in my ability to solve ethical dilemmas.	○	○	○	○	○
I feel very confident in my ability to handle difficult ethical dilemmas.	○	○	○	○	○
I feel this activity has enhanced my ability to face ethical dilemmas.	○	○	○	○	○
I can make sound decisions and I am able to explain them based on professional, ethical and legal principles.	○	○	○	○	○
I am confident in my ability to understand and evaluate education research that is related to programs and issues in my (future) school.	○	○	○	○	○
I can explain to staff and parents the decision-making process	○	○	○	○	○

of my (future) school district.					
I can make decisions within the boundaries of ethical and legal principles.	○	○	○	○	○
I am able to explain the role of law and politics in shaping the school community.	○	○	○	○	○

Part 2 - AR App

AR App Post-Survey

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
It was easy for me to use the AR app.	○	○	○	○	○
I had the capability to use the AR app.	○	○	○	○	○
I was able to use the AR app without much	○	○	○	○	○

effort.

The AR app assisted me in learning about ethical dilemmas.	○	○	○	○	○
The AR app was effective in learning about ethical dilemmas.	○	○	○	○	○
After using the app, my confidence to face ethical dilemmas has grown.	○	○	○	○	○
There was no one around to tell me what to do as I went.	○	○	○	○	○
Someone else helped me get started.	○	○	○	○	○
I had used similar technologies before this one to do the same task.	○	○	○	○	○

Part 3 - Invitation to Interview

Would you like to be interviewed about your experience using the AR app for 15 to 30 minutes via Zoom? You will receive an additional $10 Amazon gift card as a compensation for an interview.

- ○ Yes
- ○ No
- ○ Prefer Not to Answer

E-mail Address

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APPENDIX F: GUIDED INTERVIEW QUESTIONS

1. What is your future career aspiration?
2. What was your experience using Augmented Reality (AR) applications before this study?
    a. Where and when did you first learn about AR?
3. What was your experience in solving ethical dilemmas recently?
    a. Where and when did you first learn about ethical dilemmas?
4. How do you think solving ethical dilemmas will equip you to be an effective leader?
5. What has been your experience using the AR application to learn about ethical dilemmas in this study?
6. How effective has the AR application been in guiding you while learning ethical dilemmas?
    a. Did you have any difficulties? If so, can you tell me about them?
    b. What did you like best about the AR application?
7. What other leadership skills would you like to learn in your profession that you might want the AR application to help you with?
8. Do you think this AR app helped you learn and be confident in solving ethical dilemmas?

a. How did AR instructions help you to learn and increase confidence in solving ethical dilemmas?

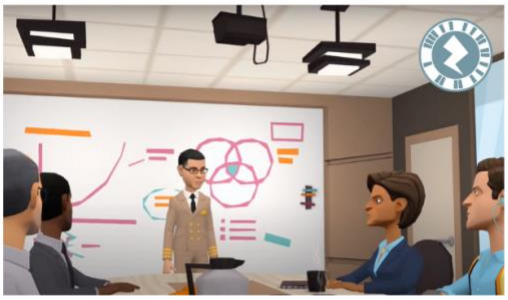
9. Do you have any recommendations for improving this AR application?
10. Is there anything else that you would like to tell me that I have not asked you about?
11. Do you have any questions that you would like to ask me?

APPENDIX G: CASE STUDY PASSAGE

CASE STUDY

THE WILD BOARS SOCCER TEAM RESCUE

In June 2018, 12 members of Thailand's Wild Boars soccer team, ages 11-16, and their assistant coach went to explore Tham Luang Cave, resulting in one of the most difficult, dangerous, and inspiring rescues in recent history. Carrying only their flashlights, the group was trapped inside the cave when the water level rose 10 feet in a flash flood. When authorities learned that the boys were missing, they began a search, suspecting that the boys had been lost in the cave. For 9 days, rescue divers battled strong current, darkness, and narrow passageways as they searched for the boys. On the 10th day, two British divers, who thought they were doing a recovery mission, surfaced to find the emaciated team members huddled on a ledge, miles from the cave entrance. Once the boys were found, the focus shifted to how to get them out of the cave.



Authorities suggested that they would have to wait for months until monsoon rains ended and the water level dropped. None of the boys could swim, and the journey out of the cave would take more than six hours, a good portion of it underwater. The danger facing the rescuers and the boys was emphasized when one Thai diver died when he ran out of air while laying oxygen tanks along the escape route.

Question 1: If you were in the position to decide what to do in this scenario, what would you do?

A

Utilize this opportunity to highlight the skills and expertise of Thai divers by restricting aid from other countries. Bring together the finest divers and doctors in Thailand and develop a plan for an immediate rescue.

B

Postpone the rescue as long as possible or until the flood waters had subsided. Keep the boys and their coach alive by bringing in needed supplies and medical assistance. Look for opportunities to pump additional air into the cave.

C

Accept assistance from other countries including American and British experts in logistics and navigation. Allow those with the most expertise to drive the direction of the rescue.

Question 2: What ethical considerations did those in authority need to consider in this situation?

Question 3: What are some of the ethical dilemmas associated with the decisions about how to transport the boys?

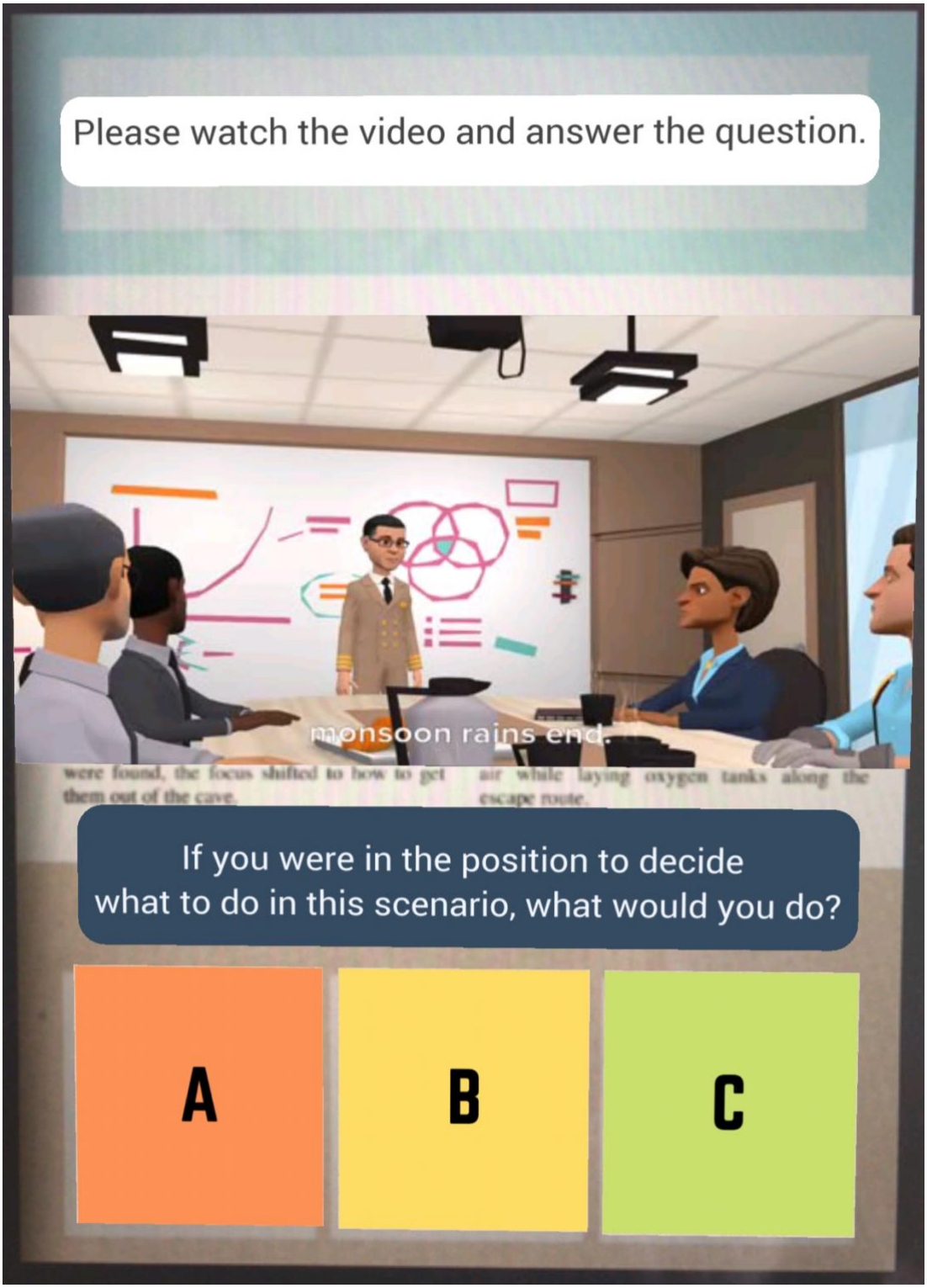
Discussion: The rescue took a period of three days in a process cloaked in complete darkness that sometimes included walking and other times included being completely submerged for as long as 40 minutes at a time. In the end, all soccer team members and their coach were rescued safely. Rescuers later discovered that the coach had taught the boys meditation techniques that he had learned as a Buddist monk, and he shared his portion of food with them when help arrived.

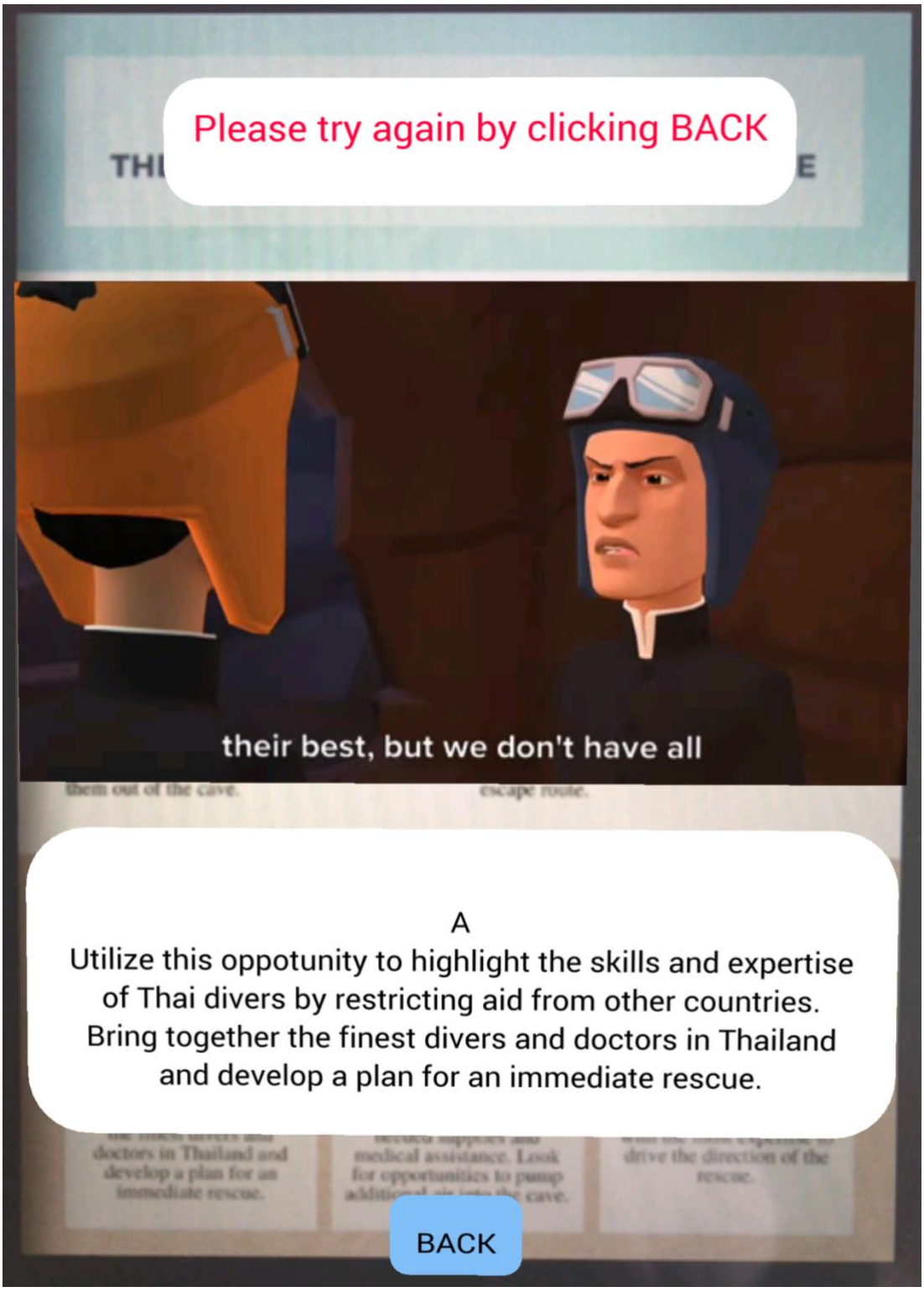
Question 4: What leadership qualities do you see in this coach?

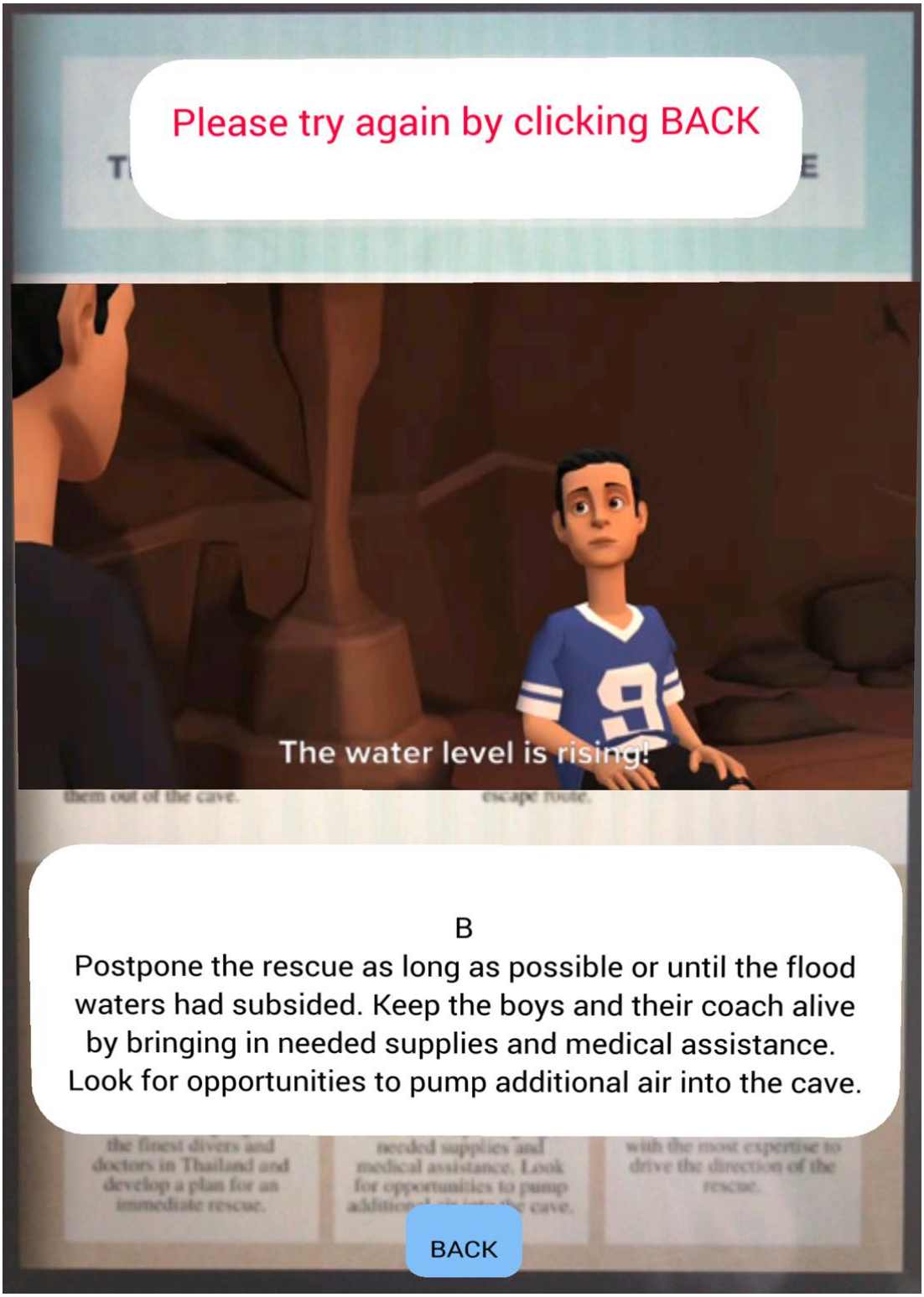
Discussion: Military doctors who stayed with the boys while they were waiting to be rescued were impressed at how orderly and obedient the boys were. After eating, they cleaned up their trash to help keep their perch clean. As the rescue was taking place, parents of all of the boys remained at the entrance of the cave until all boys and their coach were transported. The rice farmers who were impacted by the flood waters pumped out of the cave even turned down government assistance to replant their fields. One commented, "I am more than willing to have my rice fields flooded as long as the children are safe. These boys are like my children."

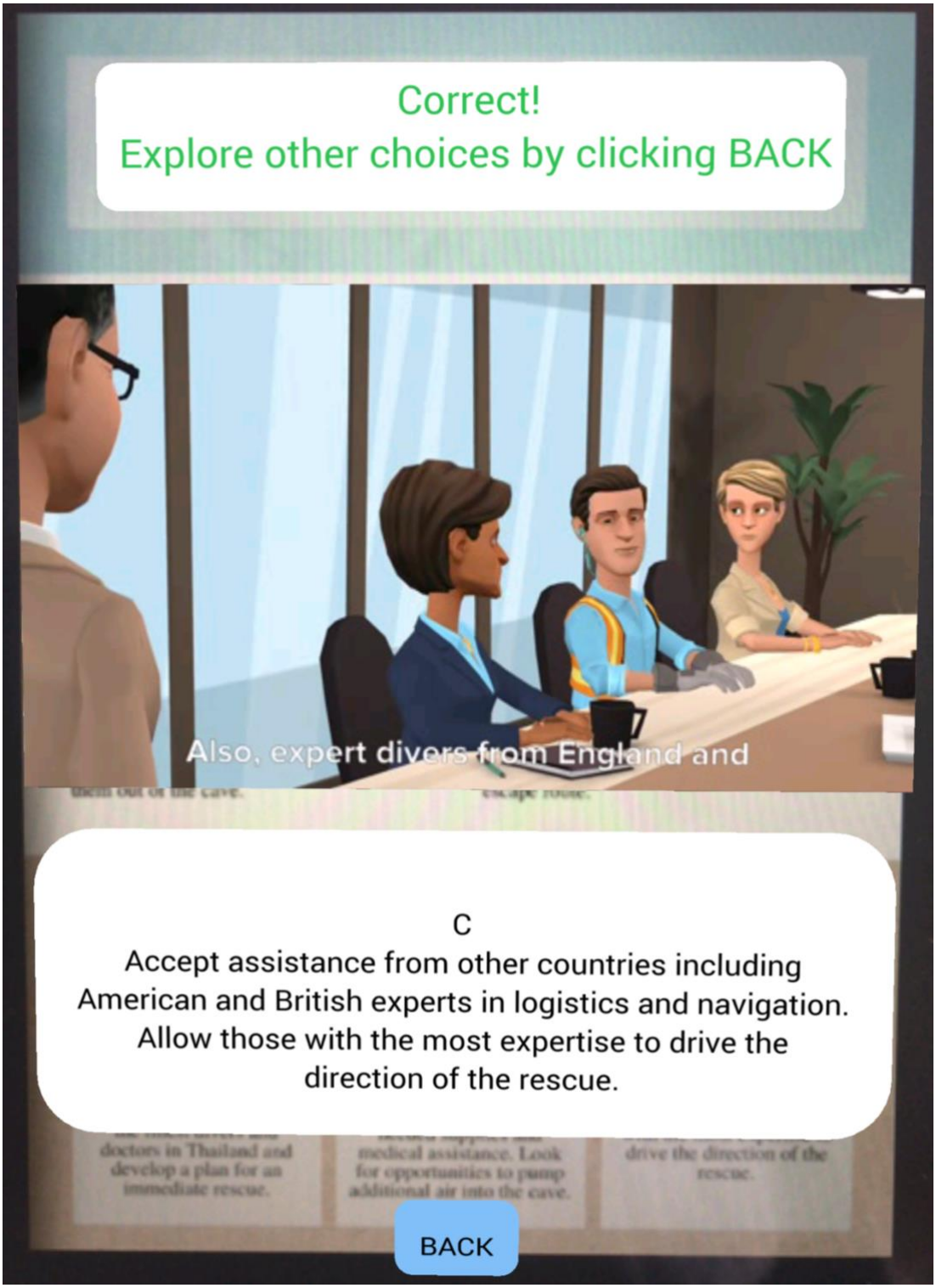
Question 5: What leadership ethics lessons can we take from the Thailand soccer team rescue?

APPENDIX H: SCREENSHOTS OF AR INTERFACE




Please try again by clicking BACK
their best, but we don't have all
A
Utilize this oppotunity to highlight the skills and expertise of Thai divers by restricting aid from other countries. Bring together the finest divers and doctors in Thailand and develop a plan for an immediate rescue.
BACK


Please try again by clicking BACK
The water level is rising!
B
Postpone the rescue as long as possible or until the flood waters had subsided. Keep the boys and their coach alive by bringing in needed supplies and medical assistance. Look for opportunities to pump additional air into the cave.
BACK


Correct!
Explore other choices by clicking BACK
Also, expert divers from England and
C
Accept assistance from other countries including American and British experts in logistics and navigation. Allow those with the most expertise to drive the direction of the rescue.
BACK

APPENDIX I: CASE STUDY SCRIPT

Option A

Diver 1: This rescue is not going well. Our rescuers are working hard and doing their best, but we don't have all the equipment and expertise we need.

Diver 2: Some of the boys and some of the rescuers have already been injured. I am worried about how this will end.

Authority 1: We had offers of help from expert divers in England and Australia. We should have accepted their help.

Head Authority: Having more than one perspective is always a good idea when facing such a tough problem. Working with experts from other countries would be better than trying to do it all on our own.

Option B

Boy 1: Oh no, the water level is rising!

Coach: We've been cold and wet for a long time. Some of the boys are now really sick.

Boys: [Coughing]

Medical Diver: We need to get these boys out of here quickly so we can treat them properly.

Option C

Head Authority: Let's accept assistance from other countries.

Authority 1: This seems like a good plan. We have a good team, but we might not have everything we need.

Head Authority: American experts have technology that can help with navigating and finding the soccer team.

Authority 2: Also, expert divers from England and Australia can find solutions to dive into the dangerous parts in the cave and rescue the team.

Explanation: The choice that Thai leaders made was "C." This turned out to be one of the finest examples of cooperative rescue efforts, both above and below ground. Groups from around the world were involved in the rescue. Thailand's new king donated supplies, and people from across the nation volunteered in tasks such as cooking, operating pumps, and checking for hidden cracks through which the boys could be lifted to safety. Over 150 members of the Thai Navy SEALs, outfitted with improvised equipment sometimes held together with duct tape, helped to plan the escape route. Americans provided the logistics, and British divers navigated the most dangerous sections of the route.

VITA

Sarinporn Chaivisit

Candidate for the Degree of

Doctor of Philosophy

Dissertation: THE IMPACT OF AUGMENTED REALITY ON PRESERVICE EDUCATIONAL LEADERS' SELF-EFFICACY

Major Field: Education, option in Learning, Design and Technology

Biographical:

Education:

Completed the requirements for the Doctor of Philosophy in Education at Oklahoma State University, Stillwater, Oklahoma in May, 2021.

Completed the requirements for the Master of Education in Curriculum and Instruction at Oral Roberts University, Tulsa, Oklahoma in 2015.

Completed the requirements for the Bachelor of Engineering in Computer Engineering at Chiang Mai University, Chiang Mai, Thailand in 2010.

Experience:

Graduate Research/Teaching Associate at Oklahoma State University, Stillwater, Oklahoma from 2017 to 2021.

Math Intervention/Computer Teacher at Discovery School of Tulsa, Tulsa, Oklahoma from 2015 to 2017.

Professional Memberships:

Association for Educational Communications and Technology (AECT)
Association for the Advancement of Computing in Education (AACE)
American Educational Research Association (AERA)
International Society of the Learning Sciences (ISLS)