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High School Teachers' Concerns With the Use of Multiple Mobile Devices for Instruction

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Walden University
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Abstract

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by

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MA, Academy of Art University, 2002

BS, University of Memphis, 1992

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Smartphones, laptops, and tablets are mobile devices that are now considered essential tools for high school educators. The problem many teachers face is figuring out how to manage multiple mobile devices in the classroom at the same time. The purpose of this qualitative case study was to explore the barriers, problems, and challenges teachers experience while using these devices in the classroom. The concerns-based adoption model provided the framework to analyze the informational, personal, management, and consequence stages of concern through in-depth interviews with 10 Catholic high school teachers in California. The results of thematic analysis showed that although teachers were already using mobile devices in their classrooms, the use of multiple devices simultaneously can magnify issues that existed with the use of a single mobile device. Self-efficacy was a concern because teachers lacked the professional development to support the use of multiple devices for instruction. Participants stated that investing in a good learning management system helped to relieve the pressure of not having a unified platform for students with different devices. Participants also expressed the benefit of having a clear policy that would maintain an active learning environment by keeping students accountable for their learning. Finally, participants expressed concerns with the barriers of accessibility and connectivity for students who had outdated devices. Providing teachers with the resources and training to manage multiple mobile devices can be a catalyst for positive social change to make multiple mobile devices effective tools for instruction in high school classrooms.

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Chapter 1: Introduction to the Study

Technology plays an important role currently in education and society. In recent years, the traditional approach to teaching has been replaced with more technologically oriented innovative practices (Williams, 2017). The use of conventional tools, such as chalk and whiteboards, is diminishing (Dias & Victor, 2017). Mobile devices are now a standard tool seen in the classrooms to support different learning and teaching strategies (Miller & Cuevas, 2017). The focus of the current study was to identify the concerns of high school teachers regarding the use of multiple mobile devices in the classroom for instruction. The findings may provide valuable information to teachers, school leaders, and policymakers to influence future instructional decision making regarding the managing of multiple mobile devices in the classrooms.

In this chapter, the introduction is followed by background literature regarding the use of mobile devices in the classroom. I present the problem statement and research questions. Next, I introduce the conceptual framework used for this study, which was the concerns based adoption model (CBAM; Hall & Hord, 2011). This is followed by sections addressing the nature of the study, definitions, assumptions, delimitations, limitations, and significance, followed by the summary.

Background

Mobile devices can no longer be considered an innovation in education (Duke & Montag, 2017). Selwyn et al. (2017) stated that advancement in technology has reformed the way personal devices are viewed and used in the classroom. In recent years, the paradigm seemed to have shifted in education, and mobile devices have become a

standard instructional tool in the classroom (Dias & Victor, 2017). The use of mobile devices in class has been seen as a natural way to adjust to the technology-dependent world, and the bring your own device (BYOD) model has allowed this transition to happen (Breach, 2019). Pine-Thomas (2017) stated that even though the BYOD model was not considered an innovation for education, its implementation has prompted concerns and challenges within the school system. Dias and Victor (2017) elaborated on how systematic change helped the transition of mobile devices into the classroom, granting educators the opportunity to engage students more innovatively.

Previous research highlighted the pros and cons of single mobile devices used in the classroom. For example, Howard and Howard (2017) discussed the challenges teachers faced when deciding which mobile device was better suited for instruction due to connectivity issues, accessibility, and equity for students. Christensen and Knezek (2017) discussed the multiple benefits of using a single device to help in personalizing the learning for students. These researchers explained that for the use of mobile devices in the classroom to be successful, teachers must feel they can both manage and enhance the learning of students using mobile devices. The focus of the current qualitative case study was to discover the concerns of high school teachers about the use of multiple mobile devices for instruction while coping with barriers associated with these technologies. Irby (2017) stated that enhancing student learning with mobile devices was the key to make teachers feel confident to synchronize the use of mobile devices as an instructional tool. Lastly, Dinc (2019) discussed the different types of barriers teachers faced when integrating single mobile devices in the classroom.

Even though these studies elaborated on single mobile devices in education, there was no research evident on the challenges and successes of multiple mobile devices being used in the classroom. The current study was designed to identify the concerns, barriers, and resources needed for the success of multiple mobile device use in the classroom. This study may help teachers deal with their concerns, barriers, and resources related to the use of multiple devices and may help teachers overcome barriers and pedagogical changes associated with the use of multiple mobile devices. Findings may also help teachers know what resources to use to manage multiple mobile devices in the classroom as instructional tools. This study may help transform the classroom by supplying teachers with the appropriate resources to integrate multiple mobile devices and enjoy the benefits these tools provide for educational purposes.

Problem Statement

The problem addressed in this qualitative case study was the concerns of high school teachers regarding the use of multiple mobile devices for instruction. Teachers are trying to figure out how to maximize the many attributes of mobile devices in the classroom regardless of the popularity and frequent use of these devices in education (Williams, 2019). Kay et al. (2017) stated that apprehension regarding the use of mobile devices was evident when teachers decided which mobile device was better suited to teach the planned curriculum. The frustration in determining which device was best for the classroom was what influenced teachers' perceptions about including multiple mobile devices as an instructional tool in the classroom (Kay et al., 2017). This apprehension was based on a multitude of concerns that created more problems for teachers in their

daily routine. The integration of multiple mobile devices simultaneously required a significant increase in the workload of the teachers because it entailed maintaining, educating, and ensuring that active learning was occurring in the classroom (Christensen & Knezek, 2017). Addressing this concern, Jin and Schmidt-Crawford (2017) explained how administrators needed to change preexisting mandates when integrating innovations because of their potential to cause a distraction in learning behavior.

Prior research regarding these technologies focused on educational use with single devices such as iPads and cellphones (Hollis, 2017; Lowe, 2017; Williams, 2019), training needed for efficient integration, and management with these single mobile devices in the classroom (Bowman et al., 2020). However, the findings related to one individual mobile device usage did not necessarily relate to the use of multiple mobile devices (Dias & Victor, 2017). For example, Chou and Block (2019) and Lowe (2017) discussed how iPads and cellphones were useful when implemented in a 1:1 scenario. Yet, these studies did not provide evidence as to whether using both devices simultaneously would produce the same positive result in a 1:1 scenario. The question arose as to how the teacher would manage both devices simultaneously.

Another aspect mentioned in previous research was the need for training with single mobile devices. Williams (2017) and Hollis (2017) discussed the importance of training requirements for single-device use; however, the training requirements for multiple mobile devices used in the classroom was not addressed. These are vital questions unanswered in prior research. The current qualitative study focused on the barriers, problems, and challenges related to concerns of high school teachers regarding

the use of multiple mobile devices for instruction. The appropriate guidelines for teachers to cope with the associated barriers, problems, and challenges with these multiple mobile devices may help the teachers feel confident when integrating multiple devices as instructional tools (see Jin & Schmidt-Crawford, 2017). The information from this study may help education progress with the successful integration of multiple mobile devices in high school classrooms by reducing the challenges teachers experience when using these tools for instructional purposes.

Purpose of the Study

The purpose of this qualitative case study was to identify the concerns of high school teachers regarding the use of multiple mobile devices as educational tools and to explore how teachers cope with the barriers, challenges, and problems faced when using these technologies in the classroom. Because there was not enough information regarding this topic, this qualitative study was at aimed investigating the perceived barriers, problems, and challenges associated with the integration of multiple mobile devices, and identifying the resources needed to help teachers manage these devices (see Kay et al., 2017). The research findings may provide administrators with information to help teachers manage multiple mobile devices for teaching and to equip them to handle any barriers, problems, and challenges.

Research Questions

The central research question (CRQ) and subquestions (SQs) used in this study were the following:

CRQ: What are the concerns of high school teachers when faced with using multiple mobile devices for teaching and learning in the classroom?

SQ1: What pedagogical concerns do teachers face when they accommodate multiple mobile devices for teaching and learning?

SQ2: What are the resources high school teachers need to use multiple mobile devices in the classroom successfully?

SQ3: What are the viewpoints of teachers about adapting to innovations integrated into their educational culture?

SQ4: What are the barriers, problems, and challenges teachers are faced with when multiple devices are used?

Conceptual Framework

The conceptual framework used for this study was the CBAM (see Hall & Hord, 2011). This model focuses on how teachers adapt to innovations integrated into their educational culture. CBAM consists of four dimensions that provide tools and approaches for leaders to have the ability to measure the concerns of everyone regarding the use of innovation to give each person the necessary support to ensure success (Hall & Hord, 1987 , 2011).

The four diagnostic dimensions of CBAM are innovation configuration, stages of concern, levels of use, and consequences (Hall & Hord, 2011). Stages of concern and

levels of use were the dimensions applied in the current study due to the insufficient information on multiple mobile devices being used in the classroom setting for teaching and learning. The stages of concern dimension provide administrators with support to identify the beliefs and attitudes of teachers regarding an innovation by using different tools to collect data (Hall & Hord, 2011). This is done so administrators know what actions to take to address those concerns. The levels of use dimension determine how an innovation is used by teachers and staff while giving information on how the innovation is implemented effectively. The levels of use help guide the efforts of teachers regarding the implementation of an innovation (Hall & Hord, 2011).

The concerns, barriers, and resources of managing multiple devices in the classroom was examined in the current study by focusing on four of the CBAM's seven stages identified in the Stages of Concern Questionnaire. The four stages (informational, personal, management, and consequence) helped me identify themes during my analysis. Level-of-use behavioral profiles helped me develop the interview protocol to explore the actions of the teachers based on their engagement with the multiple mobile devices being used in their classroom for instruction (see Hall & Hord, 2011). The CBAM framework supported the data that were gathered and coded using a thematic analysis software from the in-depth interviews. The focus on these areas helped me identify the extent to which teachers were using multiple mobile devices and how confident they were in integrating these devices within their discipline along with their thoughts about these innovations (see Hall & Hord, 2011).

A more in-depth explanation of CBAM is provided in Chapter 2 regarding the concerns teachers have with the use of these multiple mobile devices, barriers related to the pedagogical challenges teachers face when these devices are the primary tools for instruction, and resources teachers need to manage the use of these devices. This framework provided a lens for me to discover what concerns, barriers, and resources were associated with the use of multiple mobile devices in the classroom for educational purposes. The CBAM was valuable in assessing what concerns teachers had regarding the integration of multiple mobile devices simultaneously, what pedagogical challenges were apparent when accommodating multiple types of mobile devices, and what resources were needed to successfully integrate these innovations into the classroom for instruction (see Hall & Hord, 2011).

Nature of the Study

Yin (2018) explained that a case study helps the researcher understand a real-life situation in depth while clarifying the boundaries between the phenomenon and the context. A case study design within the qualitative approach was used to address the concerns of high school teachers regarding the use of multiple mobile devices in their classrooms for instruction. The case study design allowed me to investigate the views of the teachers using in-depth interviews as my tool for data collection (see Yin, 2018). These interviews provided a forum for the participants to share their views and experiences about the use of multiple mobile devices while coping with barriers associated with these technologies (see Yin, 2018).

For the current study, I recruited 10 high school teachers with at least 2 years of experience who were using multiple mobile devices for instruction. These 10 participants were selected from two Northern California Catholic high school sites. I conducted 45-minute in-depth semistructured interviews with questions informed by the stages of concern dimension. After transcribing the data collected after each interview, I familiarized myself with the data and hand coded the data to identify information related to the research questions. After this analysis, I conducted thematic analysis with a qualitative research software program for making judgments about the themes that were emerging based on the data that were collected (see Norwell et al., 2017).

Definitions

The following definitions of terms clarify their meaning in the context of this study:

Active learning: A form of learning in which the students are actively engaged in the learning process where teachers use various interaction methods to provide them with information (Hanny et al., 2021).

External barriers: The processes, activities, resources, and situations that impede someone's access to a learning opportunity (Xie et al., 2021).

Formal learning: Education that takes place inside an educational establishment. This type of learning follows a specified curriculum and is pedagogically planned or organized (Viberg et al., 2018).

Informal learning: Education that takes place outside of an educational establishment. This type of learning does not follow a specified curriculum and is not pedagogically planned or organized (Viberg et al., 2018).

Internal barriers: Issues that teachers deal with, such as self-efficacy, digital stress, pedagogical challenges, resistance to change, or technophobia (Xie et al., 2021).

Learning management systems: Systems that allow learners to communicate and interact with their teachers to work together in a new and enjoyable way (Alshorman & Bawaneh, 2018).

Mobile devices: A general term used to describe any type of handheld computer that is portable or can fit in a person's hand. Tablets, e-readers, smartphones, and laptops are considered mobile devices (Williams, 2017).

Mobile learning: A new way to access learning content using mobile devices for continuous access to the learning process (Chen & Kizilcec, 2020).

Off-task learning: Learning that occurs when a student is disengaged from the learning activities and the learning environment (Hernan et al., 2018).

On-task learning: Learning that occurs when students are fully engaged with the learning activities and the learning environment (Hernan et al., 2018).

Assumptions

One of my assumptions when conducting this study was that high school teachers were using multiple mobile devices within their classrooms for instruction. Another assumption I made was that the teachers who participated in the study would be open in their answers to the interview questions and would share their experiences truthfully

regarding the use of multiple mobile devices in their classrooms. Their openness and honesty about their experiences with the use of these devices were critical to the success of the study, and their knowledge helped me identify the concerns, barriers, and resources regarding the use of multiple mobile devices for educational purposes.

Scope and Delimitations

The focus of this study was to reveal the concerns, barriers, problems, and challenges associated with the use of multiple mobile devices in high school classrooms for educational purposes. I did not single out the use of one device or focus on a popular device but concentrated on the simultaneous use of multiple mobile devices for learning. The population was high school teachers in Grades 9–12 who had at least 2 years of experience integrating multiple mobile devices in the classroom. The population excluded from the study was elementary and middle school teachers, teachers without multiple mobile device experience, administrators, students, and other staff members. The sites for this study were private Catholic high schools. Public schools in the same district were excluded because these schools usually assign which devices students and teachers can use as instructional tools. This limited the public school's use of nonassigned devices and the simultaneous use of these devices.

I chose the CBAM model because I wanted to find out what concerns teachers had regarding the use of multiple mobile devices in the classroom for educational purposes. The substitution, augmentation, modification, and redefinition model, along with the technological pedagogical content model, help teachers use technology to teach and plan learning activities. Even though these models are beneficial to pedagogical

issues, they did not focus on the challenges and problems teachers faced with the use of technology. Christensen and Knezek (2017) discussed how important it is for schools to match the evolution of instructional mobile device use in the classroom as technology advances. The results of this study may help other Northern California school districts with similar demographics address the use of multiple mobile devices if they permit multiple mobile devices use for instruction in the classroom.

Limitations

There were a few concerns regarding the use of a small sample size for this qualitative study. The sample consisted of 10 (five participants per school) currently employed as high school teachers at two designated private Catholic schools in a selected area of Northern California. One restriction of assessing only two private Catholic high schools was the chance for limited representation of the larger population of teachers who teach one of the eight subject areas (math, history, foreign language, visual arts, performing arts, science, theology, and English). Even though these 10 participants taught one of the subject areas in a Catholic high school setting, the risk of not having a subject represented was reduced by stipulating to the administrator not to select all participants from the same subject area.

Another limitation was the potential for bias. Due to my experience using mobile devices in a classroom setting for instructional use, this could have become an issue pertaining to data collection and analysis in the current study. A protocol was developed for the in-depth interviews so that the questions asked would not be affected by my experiences or biases. Open-ended questions were presented so that a neutral stance

would be maintained as observer–participant. There was also an opportunity for the participants to receive copies of the transcripts with their answers to ensure there was no misinterpretation on my part.

Significance

The intent of this research was to discover the concerns, barriers, problems, and challenges of the teachers regarding the use of multiple mobile devices in their classrooms, as well as what resources helped teachers alleviate any concerns, barriers, problems, and challenges associated with the use of multiple mobile devices for educational purposes. Administrators and policymakers may use the findings to help teachers manage the use of these devices in the classroom. In addition, administrators and policymakers may use the findings to promote comprehensive education using an informal tool (mobile device) for formal learning, which could help transform education in the 21st century (see Viberg et al., 2021).

When teachers foster a more engaging learning environment, distractions are reduced, which helps to lessen off-task learning and leads to better classroom management (Hernan et al., 2018). To have better classroom management, teachers need to feel confident with any innovation they integrate into their classrooms (Rogers, 2003). The appropriate resources offered to teachers to manage multiple mobile devices may help teachers maintain their classrooms better, which may increase on-task learning. On-task learning fosters a more engaged classroom, which promotes social change (Hernan et al., 2018).

Summary

This qualitative case study focused on the concerns of high school teachers regarding the use of multiple mobile devices for instruction while coping with barriers associated with these technologies. Multiple mobile devices are being integrated with more frequency in the classroom. Despite the increase in adopting technologies into the learning environment, there remains a wide range of barriers that prevent teachers from effectively integrating these devices into the classroom setting (Hanny et al., 2021). Identifying the concerns, barriers, and perceptions teachers have regarding multiple mobile devices being integrated into the classroom provide more insight about these devices (see Dinc, 2019; Kay et al., 2017). Rogers (2003) explained that innovations within the classroom environment must be adopted and accepted within the environment for those innovations to succeed. Teachers must be able to overcome the challenges and concerns regarding the use of multiple mobile devices, as well as the barriers that they experience with the use of these tools in the classroom (Heflin et al., 2017; Mendoza et al., 2018; Williams, 2017). In Chapter 2, I provide a review of the current literature on the study topic. I also explain the CBAM framework and include a review of relevant, peer-reviewed literature related to teacher concerns, challenges, and perceptions of multiple mobile device use in the classroom.

Chapter 2: Literature Review

The problem addressed in this qualitative case study was the concerns of high school teachers regarding the use of multiple mobile devices for instruction and how teachers coped with the barriers, challenges, and problems faced when using these devices in the classroom. As mobile devices have become more prevalent in schools, teachers have struggled to address the barriers, problems, and challenges to effectively integrate technology into the classroom setting (Beatty et al., 2017; Chou & Block, 2019; Heflin, Shewmaker, & Nguyen, 2017; Sung et al., 2017; Xie et al., 2021). The BYOD model created a platform for mobile devices to help improve student learning through the extension of every student having access to a device. The BYOD model helped students become more engaged with their learning while also improving collaboration and engagement when they were allowed to use their own devices in the classroom (Bond & Bedenlier, 2019; Rodriguez-Triana et al., 2020; Winterhalder, 2017).

While schools sought to adopt BYOD approaches in the classroom, researchers found that many teachers failed to accept the inclusion of multiple mobile devices or failed to understand how these technologies were used within the learning environment (Beatty et al., 2017; Bowman et al., 2020; Chou & Block, 2019; Hobbs & Hawkins, 2020; Sung et al., 2017). If high school teachers were unprepared or unequipped to integrate these devices and technology platforms effectively, it dissuaded schools from capitalizing on the potential of the BYOD approach (Williams, 2019). To overcome these barriers, problems, and challenges in the classroom, high school leaders and administration members needed a comprehensive overview of the situation when the

changes were implemented that was holding teachers back from fully embracing the BYOD approach (Hobbs & Hawkins, 2020; Hodges et al., 2020).

Sung et al. (2017) pointed out that teachers having the confidence to integrate technology into their classroom will determine the effective use of these innovations for education. Findings from the current study could provide administrators and decision makers with information to help teachers manage multiple types of mobile devices for learning (see Sung et al., 2017). In this qualitative case study, the first step was reviewing the relevant literature on the topic.

In this literature review, I expand on the background of the research problem discussed in Chapter 1. The first section of the literature review focuses on the search strategy used to conduct the literature review. The second section focuses on the conceptual framework of the study (CBAM). Following these sections, the literature review focuses on the themes identified in current literature, which included the concerns for integrating mobile devices in the classroom (Bernacki et al., 2020; Cho, 2017; Christensen & Knezek, 2017, Strigh, 2017; Wilson, 2021); pedagogical challenges with the technologies (Bowman et al., 2020; Diacopoulos & Crompton, 2020; Reichart & Mouza, 2018; Sung et al., 2017; Williams, 2019; Winterhalder, 2017); and barriers, problems, and challenges associated with the use of multiple types of mobile devices (Anderson & Jiang, 2018; Chou & Block, 2018; Hanny et al., 2021; Kay et al., 2017; Hernan et al., 2018; Heflin et al., 2017; Hollis, 2017; Mendoza et al., 2018; Selwyn et al., 2017). The chapter concludes with a summary of the findings.

Literature Search Strategy

The search engines and library databases used included Google Scholar, EBSCOhost, Education Research Complete, the Education Resource Information Center (ERIC), ProQuest Central, and ScholarWorks at the Walden University Library. Government reports were also used from these databases to provide more information on the topic and current practices related to BYOD and mobile devices in high schools. Search terms included *educational technology*, *mobile devices*, *learning and teaching with mobile devices*, *mobile devices in secondary education*, *pedagogical issues with mobile devices*, *teachers' perceptions of mobile devices*, *effective integration of mobile devices*, *teachers concern with mobile devices*, *smartphones in secondary classrooms*, *iPads in high school classrooms*, and *mobile device distractions in high school classrooms*. The articles included in the literature review were published no earlier than December 2017, except where noted. The iterative search process began by using key terms such as *educational technology*, *mobile devices*, and *teachers' concerns with mobile devices*, which provided the initial search results on the topic. Following a review of the initial literature, more complex search terms were used to reduce the number of results and provide more focused results for the literature review based on the research problem and the research questions. Each article selected for the review was organized in an electronic file based on the key concepts and relatability of the study. The major themes that emerged included concerns of teachers integrating mobile devices into the classroom, pedagogical problems, challenges, and how to deal with barriers associated

with the use of mobile devices. Older articles relevant to the study were not used unless necessary and noted.

Conceptual Framework

The conceptual framework used for this study was the CBAM. The CBAM was created in 1973 by a team of researchers and further developed by Hall and Hord (1987) to focus on how individuals adapted to innovations integrated into their organizational culture. Hall and Hord (1987) recognized that when educational reforms are implemented within the school system, they are not always applied in the expected time frame given the attitudes and behaviors of the individuals tasked with adopting the changes (. The CBAM was designed to describe, explain, and predict probable behaviors throughout the change process within a school organization (Hall & Hord, 2011). The CBAM was developed for individuals who experienced change within the organizational system, which when applied to the education system that includes not only teachers but also administrators, educational policymakers, students, and parents (Hall & Hord, 1987, 2011). The framework focuses on identifying how the individual evolved during the change process by addressing the shift toward self-oriented questions regarding why a change has occurred and how it will affect them, along with providing a framework to investigate how the individual adopts the changes into their daily routines (Hall & Hord, 1987, 2011).

The CBAM is designed to assess seven different stages of concern that will be experienced by the individual when the change process is implemented (Hall & Hord, 1987, 2011). The first stage focuses on the awareness the individual has for the change

and why it is taking place (Hall & Hord, 1987). The second stage is information, which occurs when the individual has begun to learn more about the change and makes their initial decision regarding how effective the change is (Hall & Hord, 1987). The third stage is identified as personal when the individual begins to look at how using innovation can affect them directly. In contrast, the fourth stage is focused on the management of change and how the individual spends their time preparing to use the innovation (Hall & Hord, 1987). The fifth stage is when the individual begins to consider how the change is affecting the students (Hall & Hord, 1987). The sixth stage, collaboration, is when the individual starts to become concerned with how they are using the innovation compared to how other teachers are using it in their classrooms (Hall & Hord, 1987). The final stage, refocusing, takes place when the individual begins to build on the change and begins to come up with their improvements based on their knowledge and experience with implementing the change (Hall & Hord, 1987).

The CBAM has been applied in previous studies regarding the change process within the classroom. Cho (2017), for example, used the CBAM to identify how the seven stages of concern improved the integration of mobile devices and led to more seamless integrations when the change process was implemented within a school. Cho examined how a school's mission and vision can influence the integration of one-to-one initiatives for technology. The CBAM and the seven stages of concern are a method of measurement for identifying how well teachers adapt to technological changes within the classroom. Cho found that applying the CBAM in a mixed-methods case study could provide teachers with valuable insights into their stage of adoption of new technology.

Overall, the CBAM has been found to offer ideas to administrative members, policymakers, and individual teachers when it comes to identifying where teachers are in the change process and the barriers that prevent teachers from continuing to the seventh stage in which they have fully adopted the new practices (Cho, 2017; Hall & Hord, 1987).

Because the present study focused on identifying how teachers adopt new technologies through BYOD and multiple mobile devices in the classroom, the application of the CBAM provided information on the barriers to successful adoption in the classroom. The use of the CBAM as the conceptual framework also provided me with an overview of the stages of concern, which allowed for a comparison of how participants in the case study moved through the seven stages or if they were unable to progress through the stages due to a lack of training or ongoing support. The hope was that the use of the CBAM would reveal individual concerns of teachers adopting multiple types of mobile devices into their classrooms. The concerns, behaviors, and implementation were examined with CBAM's dimensions of the stages of concern focusing on mainly four of the seven stages. The CBAM was valuable in assessing and measuring the pedagogical challenges teachers experienced when integrating multiple types of mobile devices and the resources needed to support their use.

Literature Review

This section of the review focuses on three themes identified in the articles that related to the teachers concerns about mobile devices used as instructional tools: (a) concerns for integrating mobile devices into the classroom (Bernacki et al., 2020; Cho,

2017; Chou & Block, 2018; Christensen & Knezek, 2017; Strigh, 2017; Viberg et al., 2021), (b) pedagogical challenges with the technologies (Diacopolous & Crompton, 2020; Heflin et al., 2017; Hernan et al., 2018; Liao et al., 2017; Miller & Cuevas, 2017; Oliveria et al., 2019; Reichart & Mouza, 2018; Winterhalder, 2017), and (c) how to deal with barriers associated with the use of multiple types of mobile device (Anderson & Jiang, 2018; Duke & Montag, 2017; Gupta & Irwin, 2017; Hanny et al., 2021; Heflin et al., 2017; Hernan et al., 2018; Hollis, 2017; Kay et al., 2017; Mendoza et al., 2018; Selwyn et al., 2017).

Concerns for Integrating Mobile Devices in High School Classrooms

Researchers identified two subthemes that educators encountered when attempting to implement mobile devices into high school classrooms: (a) integrating a balance between formal and informal learning (Bernacki et al., 2020; Strigh, 2017) and (b) being prepared to integrate mobile devices in the classroom (Cho, 2017; Christensen & Knezek, 2017; Dias & Victor, 2017).

Understanding the Difference Between Formal and Informal Learning

The line between formal and informal learning becomes blurred when mobile technologies are constantly being used in the classroom (Bernacki et al., 2020; Viberg et al., 2021). Formal learning has been considered necessary for the classroom setting so that students receive structured content delivery. In contrast, informal learning has been deemed essential if the teacher maintains student engagement levels in the classroom (Bernacki et al., 2020). Due to the changing norms regarding mobile technology use, standards that once focused on the teachers' skill set with mobile technology has shifted

to a focus on teachers integrating mobile technology into the curriculum and pedagogical practices (Bernacki et al., 2020). This shift in interest later manifested as teachers being more concerned with what mobile technology could replace rather than their knowledge of using these innovations (Bernacki et al., 2020).

In a qualitative single case study, which included 500 student participants, Strigh (2017) expanded on the formal and informal balance in the classroom as it related to the adoption of new technologies and barriers to successful change. Teachers who sought to adopt mobile technologies faced a wide range of complex challenges as they attempted to blend the latest technologies with the traditional classroom model (Strigh, 2017). Regardless of the teachers' levels of support to implement changes within the classroom, Strigh found that successful adoption came down to the teachers' perceptions of the technologies and their role in the classroom.

These perceptions could be shifted with the right leadership, as teachers were more likely to perceive the new technologies positively if school administrators set persuasive examples and promoted the change (Strigh, 2017). In the study by Bernacki et al. (2020), the connection between mobile and psychological learning was discovered. Bernacki et al. studied mobile learning theory and three ways mobile technology impacts learning with mobile devices: (a) how it affects the process of learning via interactions with other psychological constructs, (b) how it affords new opportunities to directly influence the learning process or outcomes, and (c) how it provides opportunities to collect previously unobtainable data that improve understanding and modeling of the learning process. Bernacki et al. examined learners from different levels of teachers who

engaged in mobile technology from different academic platforms. A mobile app was developed to leverage mobile devices with experienced sampling methods. This mobile app was uploaded onto mobile devices by preservice teachers to use in their undergraduate courses. The app was periodically used by students to report information regarding their planning for study sessions. The goal for this study was to provide a more holistic view of how professional development helped teachers use mobile devices across a broad range of academic domains.

Miller and Cuevas (2017) found that students were more motivated and engaged if the right mix of mobile devices and educational platforms, or apps, were used within the classroom. In addition to better engagement paired with higher levels of teacher training, leadership, management, and policy support, teachers would be better equipped to find a healthy balance between the formal and informal approaches to teaching within the classroom (Bernacki et al., 2020; Strigh, 2017; Viberg et al., 2021). For school leaders to provide the correct level of support to teachers during the change process, school leaders must have a firm understanding of the factors prohibiting change (Strigh, 2017). Strigh (2017) identified three critical factors in their study that were associated with technology adaptation among middle school teachers: (a) entry-level adaptation, (b) confidence to utilize technology for instruction and student use, and (c) the integration of technology for student use for learning. For many years, teachers had controlled the instructional practices used in their classrooms (Strigh, 2017). However, Strigh found with new policies and changes in their curriculum, teachers struggled with keeping the formal model of teaching in place when introducing an informal tool such as student

laptops to the classroom. Regardless of the type of mobile technologies integrated into the classroom, researchers have found that the techniques on the devices must promote higher learning for the students if they are to be useful in a classroom setting (Chou & Block, 2019; Strigh, 2017; Viberg et al., 2021). If school administrations want to create meaningful change within the learning environment through the introduction of mobile devices, then the school leaders and policymakers must also ensure that the teachers have the appropriate resources and software programs to support improved learning (Bowman et al., 2020; Williams, 2019).

A primary concern for successful integration among teachers has also been identified as resource-based in terms of the time given to teachers to learn how to use software or apps before adopting them within the classroom (Bowman et al., 2020). In the quantitative study by Bowman et al., (2020), the authors found that teachers faced significant types of barriers when integrating mobile devices into the classroom setting. Bowman et al., (2020) described two types of barriers teachers usually experience when integrating an innovation. Those barriers are first-order and second-order barriers (2020). First-order barriers deal with the expectation a teacher regarding the culture and vision of their classroom, a school's mission, and the usage of these innovations (Bowman et al., 2020). Second-order barriers focuses on the value and beliefs regarding the usefulness to the classroom and the students (Bowman et al., 2020). Bernacki et al., (2020) who shares similar beliefs regarding first and second order barriers teachers face with integration believe that second-order barriers are not portrayed in a lot of previous studies.

Both Bowman et al., (2020) and Bernacki et al., (2020) felt it is important in determining the success of integration of technology in both classroom and curriculum. The outcome suggested that professional development programs should target teachers with low value beliefs to help them shift to a more positive attitude toward technology integration.

Vision, Mission, and Technology Implementation

While there are benefits integrating mobile devices into the classroom, the benefits are only fully realized when there is strong administrative support and leadership in place who support professional development (Bernacki et al., 2020; Bowman et al., 2020; Cheng, Lu, Xie, & Vongkulluskn, 2020; Strigh, 2017; & Viberg, 2021). Like Bernacki et al., (2020) and Bowman et al., (2020), Cheng et al., (2020) agrees that there are two types of barriers that can obstruct successful integration of mobile devices as a tool for instruction. However, Cheng et al., (2020) stipulated that if the effective implementation of mobile devices were to be achieved and maintained, then the administration would need to implement a tailored professional development plan for each teacher on a school-wide scale. The caveat to tailored professional development plans is making sure administration truly understands the need of the teachers individually before prescribing universal training. A few authors shared in the belief of first and second order barriers. Strigh (2017) expanded further on this in her study, as she found that the successful adoption of mobile devices in the classroom not only required professional development but high levels of leadership throughout the school and ongoing management practices to continue to make improvements or address concerns

from teachers. These practices, however, must be reflected in the school's overall culture (Cho, 2017).

Organizational culture in general and within a school organization is guided by the organization's overall mission and vision for the future (Cho, 2017). In a mixed-method case study, Cho (2017) selected a Jesuit high school in the Midwestern United States, which was in the second year of its 1:1 initiative. Based on the school's formal mission statement, Cho (2017) determined the importance of the school's overall identity is based on the mission and vision statements of the school. It was also concluded in Cho's (2017) study that the mission and vision statements also accentuated a student's academic, personal, and social development, along with dictating how technology fits within the school's structure.

Cho (2017) argued that CBAM was necessary to stress the importance of creating a seamless transition of integration while remembering the school's identity when creating its updated vision statement. Cho (2017) made a case for including mobile devices into the school's mission and vision for the future to foster an improved approach with the implementation of mobile devices. Cheng et al. (2020) supported Cho's (2017) findings by showing the need for school administrations to provide a reliable support system for higher rates of successful mobile device integration. Certain obstacles must be removed from the learning environment for K-12 classrooms for mobile technology to be successful (Cheng et al., 2020). The authors found that administrative support within a supportive school culture was needed to champion change when encouraging experimentation with mobile technology (Bowman et al., 2020; Cho, 2017). When a

supportive school structure along with a supportive culture focused on technology integration was in place, the challenges of day-to-day procedures, classroom instruction, and professional development were reduced, and teachers were found to be more confident in their abilities to integrate technology in the classroom (Bowman et al., 2020). Bowman et al.'s (2020) study established that this approach would allow teachers to become more confident, which in turn, will enable them to be more experimental with the devices in their curriculum and classroom.

Pedagogical Challenges With Implementing Mobile Devices

Researchers pointed out several pedagogical challenges that could determine the willingness of educators attempting to implement mobile devices into high school classrooms. These pedagogical challenges include (a) teaching and learning with mobile computing devices (Christensen & Knezek, 2017; Dias & Victor, 2017); (b) the assimilation of new technological and pedagogical skills (Diacopoulos & Crompton, 2020); and (c) perception affects mobile device success (Winterhalder, 2017). While the studies of Bowman et al., (2020); Bernacki et al., (2020); Viberg et al., (2021); Cheng et al., (2020); Strigh, 2017; Cho (2017) and Wilson, (2021) pointed out general aspects regarding the concerns of integrating mobile devices, these researchers neglected the critical understanding of pedagogical challenges that stem from the implementation of mobile devices as an instructional tool.

Teaching Practices and Learning With Mobile Computing Devices

When integrating mobile devices into the classroom, especially when incorporating BYOD approaches compared to designated classroom devices, there are

specific factors that facilitate improved technology integration among teachers (Miller & Cuevas, 2017; Reichart & Mouza, 2018). In a qualitative descriptive case study, Miller and Cuevas (2017) observed 104 sixth grade social studies students where mobile devices were integrated. This study was used to determine the more effective approach between the use of mobile devices compared to that of traditional methods (Miller & Cuevas, 2017). The areas of focus for this study were the changes in students' attitude regarding their approach to learning pre-incorporation of mobile devices compared to motivation after these innovations were integrated into their class. Based on the information from the study which highlighted the importance of mobile devices within the classroom and motivation to continue the use of an alternative for desktops, these devices were adopted in the classes (Miller & Ceuvas, 2017).

The benefits of positive integration techniques were found to be worth the teacher's time spent learning about the devices, their platforms and using them to improve their lesson activities. However, the full range of underlying challenges must be addressed at the outset of any technological integration in the classroom (Reichart & Mouza, 2018). Reichert and Mouza's (2018) multi-case study examined nine middle school teachers in a private school for boys in the United States. The authors' study used a four-year, 1:1 initiative that dealt with what the teachers deemed as benefits and challenges related to the implementation of mobile devices in real classroom contexts (Reichart & Mouza, 2018). The authors identified seven overlapping categories of knowledge that teachers should employ to improve integration and overcome commonly shared challenges: *mobile learning literature*, *teacher pedagogy*, *flexibility and choice*,

personalized instruction, student outcomes, mobile apps, lesson plans, and *low/high scoring lessons* (Reichert & Mouza, 2018). These categories listed show that high school administration and policymakers must have a high degree of knowledge regarding the challenges faced by teachers if multiple mobile devices were to be successfully integrated into the classroom (Reichert & Mouza, 2018).

The choice of technology chosen to be implemented also has a significant impact on the success of implementation (Howard & Howard, 2017). In a two-year explorative mixed-method study, Howard, and Howard (2017) observed classrooms in an urban high school setting to find examples of how tablets were used to help students become engaged and motivated in their learning. The authors found that a learner-centered framework built social interactions amongst learners, which helped promote a partnership model to change educational settings from a "voice and choice" approach to blended learning (Howard & Howard, 2017). The levels of collaborative learning with a research-based, inclusive structure wielded positive collaborative tasks amongst teachers and students (Howard & Howard, 2017). The success of the tablets in Howard and Howard's (2017) study was based on a selection of apps used in the classroom for instructional learning chosen by students and teachers, which was supported by the findings of Bernacki et al. (2020) and Strigh (2017). Integration of mobile devices in the classroom is more successful when teachers have the choice to adopt specific apps that fit with their lesson plans based on the teacher's knowledge of how the apps function (Miller & Cuevas, 2017; Howard & Howard, 2017; Richart & Mouza,2018).

Assimilation of New Technological and Pedagogical Skills

A teacher's instructional type has also been found to be impacted using technology, which in turn can either promote or detract from student engagement when mobile devices and apps are implemented in the classroom (Hanny, Arnesen, Guo, Hansen, & Graham, 2021). Hanny et al.'s (2021) qualitative study interviewed 62 blended teachers using 90-minute semi-structure interviews of K-12. The research identified the external and internal barriers and enablers to technology being integrated into the classrooms. Interior barriers ranged from lack of administrative support, accessibility for devices and applications for devices, devices, and funding to support device usage (ie: professional development and technology). External factors helped created barriers due to the lack of administrative support, restrictive policy and procedures, limited funding, pressure of state-mandated curriculum and pacing (Hanney et al., 2021). Like the findings by Strigh (2017), Hanney et al. (2021) found that the teachers who were willing to integrate technology into the classrooms benefitted by seeing improvement in their pedagogy by an increased community and efficiency.

Perception Affects Mobile Device Success in the Classroom

While some researchers have focused on the challenges related to equipment, apps, and administrative support to achieve successful mobile device integration, other researchers have turned their attention towards the training required of teachers for implementation to be successful (Bernacki, Greene, & Crompton, 2020; Chou & Block, 2019; Cho, 2017; Christensen & Knezek, 2017; Viberg, Andersson, & Wilkund, 2021; Strigh, 2017). In Winterhalder's (2017) two-year phenomenological study, the author

debated whether the training for teachers regarding mobile technology was the determining factor for mobile devices being accepted into the classroom. A total of 10 teachers from grades 6-12 were included in the study from two educational sites (Winterhalder, 2017). Both Winterhalder (2017) and Christensen and Knezek (2017) discovered that successful integration and acceptance into the classroom was based on comprehensive training, teacher's perceptions of the technology, beliefs that the technology would improve learning, and willingness to integrate mobile devices. These factors were more important than the support of the school administration or available resources.

If teachers are to implement a BYOD model in the classroom successfully, teachers are ultimately the ones responsible for finding successful methods for integrating the devices into the curriculum and individual lesson plans (Winterhalder, 2017). Teachers would be unable to accomplish this, however, if they were not given the proper training and if they were unfamiliar with the devices or the apps that would be used in the classroom setting (Bowman et al., 2020; Winterhalder, 2017).

Winterhalder's (2017) study also argued that establishing a proper guideline model can help integrate mobile devices. Researchers Chou and Block (2019) reinforced the need for appropriate guidelines when incorporating mobile devices into the classroom. Still, their approach underlined the need for support to build the teacher's confidence in the tools used for instructional learning. School leaders and administrators must be able to identify individual challenges facing mobile device integration within different schools which will provide more teacher support and improve the likelihood of

successful adoption in the classroom (Dinc, 2019; Chou & Block, 2019). Like the findings of Winterhalder's (2017) study and promoting a better system to enlist professional development programs for mobile device training, Chou and Block's (2019) pedagogical mixed-method research aimed at finding the patterns of instructional activities and perceptions of teachers and students using iPads in the classroom. The study of Chou and Block (2019) focused on what purpose teachers used these devices for in the classroom and the students' perceptions regarding the outcome of usage with mobile devices.

Chou and Block's (2019) study consisted of one of the largest K-12 school districts in the Midwest USA, with more than 32,000 students with a diverse population in the school district. Multiple carts were dispersed with the implementation of an iPad cart initiative in two years, with over 144 carts in 31 schools supporting both geography and social studies classes (Chou & Block, 2019). To help manage a better support system for a BYOD program, the study of Chou and Block (2019) used a Substitution, Augmentation, Modification, and Redefinition (SAMR) framework to examine what teachers do with iPad carts in the classroom to assess better, how and why mobile devices can better assist in active learning. The difference between the teacher's instructional patterns and student desired learning was observed through a two-day professional training in a summer academy (Chou & Block, 2019). The authors found that the students' restricted learning activities did not allow them to maximize the use of the iPad. Still, it did allow for the students to lean towards using collaborative skills (Chou & Block, 2019).

One of the primary drawbacks in the use of shared iPads or other devices compared to BYOD approaches, however, was that even teachers who have proven high levels of proficiency with the equipment were less likely to integrate the device into their lesson plans (Chou & Block, 2019). Chou and Block (2019) found that even though there were devices available, and teachers were proficient with them to some degree; they lacked training when it came to the integration of the device into the lesson. With the assortment of complications with single mobile devices and the pedagogical challenges of teachers with mobile devices, the task of active learning must be compounded for teachers when the inclusion of multiple types of mobile devices are now a part of daily assignments (Chen & Kzilcec, 2020).

Student engagement and motivation with on-task learning with multiple devices go beyond the managing of one device. Teachers are trying to balance numerous devices equally and simultaneously face increased challenges to successful implementation (Howard & Howard, 2017). Teachers will have to re-evaluate their approach to a more modern structure with more than one mobile device in mind to be successful with multiple mobile devices in the classroom (Cheng et al., 2020). This would challenge the teachers' perception of mobile device inclusion due to the constraints in training materials, time, classroom management, and other aspects of their pedagogical approach (Winterhalder, 2017). Traditional teacher practices are now in question because the previous instructional model is no longer supportive of mobile devices, especially multiple mobile devices (Xie, Nelson, Cheng, & Jiang, 2021). For teachers to initiate the

right format for active learning, training must be deliberate and structured for multiple types of devices instead of a single mobile device (Hollis, 2017).

Barriers, Problems, and Challenges Associated With Mobile Device Use When Integrated in Classrooms

Researchers pointed out two main factors that contributed to different ways mobile devices effect on-task learning and classroom management for educators implementing mobile devices. The detected barriers associated with mobile device use in the classroom include (a) internal and external barriers (Hanney et al., 2021) and (b) teacher and student behaviors (Heflin, Shewmaker, & Nguyen, 2017). Although student behavior is not the focus of the study, it can affect teacher perceptions and behavior.

Internal and external barriers will be considered first when determining the challenges to successful classroom integration (Hanney et al., 2021). In a study, Duke and Montag (2017) indicated how cellphones can impair learning during a lecture. This study elaborates on the study by Heflin et al., (2017) even though the study of Heflin et al., (2021) focused on the internal and external barriers pertaining to integration of mobile devices, Duke and Montag (2017) study spotlighted the overuse of mobile phones for work-related productivity. In a study, Duke and Montag (2017) investigated excessive cell phone use and the loss of productivity. The study examined a link between smartphone overuse and loss of productivity by assessing private and work-related smartphone use. Between January 2016 and September 2016, over 605 participants (248 males and 357 females) were asked to complete an online questionnaire pertaining smartphone ownership, private and work-related smartphone use in hours per week,

smartphone addiction and productivity. A short Smartphone Addiction Scale (SAS) used a ten-item scale to assess on a six-point Likert scale with less addictive tendencies corresponding to the lowest score (10) and greatest addictive tendencies to the highest score (60). The study sought to explore the connectivity between smartphone addiction, smartphone interruptions, and work-related productivity. The relationship between these variables displayed how negative effects on productivity in the workplace in participants daily lives (Duke & Montag, 2017)

In the study by Mendoza et al., (2018) the authors found that high school students were proficient in cell phone use and that the cellphones could be used to support learning and student engagement. While Mendoza (2018) believed that policies should be put into place to help the use of cell phones in the classroom, other researchers such as Selwyn et al. (2017) have argued that the use of personal mobile cell phones may be more of a distraction than a learning tool in the classroom. If there is a distraction, handling such a situation could become a problem and a challenge to the teachers.

One of the primary arguments that have been made by researchers in support of BYOD approaches and the use of cell phones in the classroom has been that policies can be developed so teachers can be trained to promote engagement using cellphones. This will help improve learning rather than to distract students from what is going on in the classroom when cellphones are used (Hollis, 2017).

In a study, Hollis (2017) articulated the need for teachers to be adequately trained in mobile technology for correct student mobile device engagement, while Selwyn et al.'s, (2017) study argued that there are more factors to the distractions of mobile devices

than inadequate training of teachers. The study of Selwyn et al. (2017) answered questions about their classroom use of digital devices for non-class related purposes. Three Australian government-run school sites with BYOD models were surveyed in an ethnographic case study by Selwyn et al. (2017), where the authors questioned whether personal devices used in the classroom was a good fit for the BYOD model. The authors observed that the abundance of digital devices was altering the educational experiences for the students and staff from the micro, meso, and macro-level of analysis (Selywn et al., 2017).

Other researchers have had similar findings and have argued that mobile devices and cell phones may not be in the best interests of learners (Kay et al., 2017). The study of Kay et al. (2017) was like Selwyn et al. (2017), as the authors wanted to uncover other factors causing issues with active learning. Kay et al.'s (2017) study examined in a mixed-method comprehensive framework the frequency and influence of technology-based distractions in secondary school classrooms that use a BYOD model. Kay et al.'s (2017) study involved 181 secondary school students from three schools and discovered two main factors within this study; distracting behaviors (communication, searching the web, and entertainment) and the factors that influence distracting behaviors (gender, peer behavior, instructional method, restrictions). These distracting behaviors were found to affect student engagement while they used mobile devices in the classroom. Students engaged in at least one of the three distracting activities with their mobile devices in the study conducted by Kay et al. (2017), which supported the argument made by Selwyn et

al. (2017), that teacher training was not the only reason that students were distracted by mobile devices in the classroom.

While there have been arguments that have been made about the benefits of the BYOD model compared to designated classroom devices, there has been evidence that BYOD may not be the best approach for maintaining student engagement and reducing distractions (Chou & Block, 2018; Kay et al., 2017). To help alleviate distractive behavior with mobile devices, the study of Kay et al. (2017) offered a concurrent model of quantitative and qualitative data analysis to understand the frequency of various distracting activities displayed in BYOD classrooms. Kay et al.'s (2017) research disclosed the negative impact of distracting behaviors associated with mobile devices. Students were less distracted when their peers were using mobile devices compared to their own use of mobile devices (Kay et al., 2017). Mobile device use was also revealed as a distraction when students were working independently or in group work but less distracting when lectures were given or during student presentations (Kay et al., 2017). From the above discussion, it appears that the use of mobile devices could lead to distraction, which in turn could create problems and challenges for the teachers.

In the study by Mendoza et al. (2018), the authors elaborated on nomophobia, or the fear of being without one's phone, as being a key distraction for students in the classroom as they felt the need to always have their mobile device with them. This was per Kay et al.'s (2017) mixed-method study attempt to improve technology-based distractions and understand the teenage student's experience with mobile devices. Both studies focused on how mobile devices factor into a student's learning (Kay et al., 2017;

Mendoza et al., 2018). In a quantitative group study, Mendoza et al. (2018) selected 160 students to be assigned to a four-group condition for investigation of cellphone policy impact on learning. Each group represented a different impact; (a) cellphone use and possession permitted; (b) cellphone use not permitted–put it in silent mode with possession; (c) complete removal of a cellphone from participant's possession; and (d) a control group with no instruction on cellphone use.

Students who were without their phones were found to score lower on tests and have impaired levels of learning due to nomophobia (Mendoza et al., 2018). Nomophobia was a significant factor in the poor performance across the four quarters of the academic year involving the students' quiz scores (Mendoza et al., 2018). The fear of being without a phone should be considered as a lesser distraction compared to students who have access to their devices in the classroom. Some researchers, such as Anderson and Jiang (2018) have looked at the distraction of cellphone from a social media perspective, citing concerns among teachers and parents for students using social media in class and added to the student's social pressures due to always having access to social media through their mobile devices. For BYOD to be effective in the classroom, teachers would have to have secure management practices in place that focused on student learning and reducing distractions from personal devices (Hernan et al., 2018; Kay et al., 2017; Mendoza et al., 2018).

While other researchers have looked at the importance of administrative management, other authors have studied the need for strong teacher management within the classroom setting, which would be something that teachers would have to learn

through professional development and training programs (Hernan et al., 2018; Strigh, 2017).

In Hernan et al.'s (2018) study, the authors determined that a lack of a classroom management strategy for the inappropriate use of mobile devices impacts learning in the classroom. Hernan et al.'s (2018) study used a Good Behavior Game (GBG) case study that created a strategy to help initiate responsible use and inclusion of mobile devices in primary and secondary education, which can determine a successful integration of mobile devices. The GBG was created to instill behavioral management strategies for students on a reward basis, so mobile devices wouldn't be the cause of failing to take part in on-task learning (Hernan et al., 2018). This reward system is designated by the students to incorporate what they feel is their favorite reward without rearranging classroom structure but creating a responsible learning space (Hernan et al., 2018).

Behavioral management strategies have been found to foster more on-task learning. To encourage better behavioral management strategies, students need to be invested in their education (Hernan et al., 2018). Behavioral management strategies promote more engaged learners and alleviate the inappropriate use of mobile devices in the classroom (Hernan et al., 2018). Hollis (2017) reinforced the need for proper guidelines when incorporating personal electronic devices into classroom learning in the author's qualitative action research study. Hollis's (2017) study exposed the importance of creating a policy for personal electronic device usage in the classroom. Using a sample of junior high school educators, Hollis (2017) showed how a teachers' perception determines the success of mobile device integration and on-task learning in the classroom

through the establishment of proper classroom guidelines. As with the findings of other researchers, teacher perception of mobile devices in the classroom was the key indicator for successful integration and improved learning among students (Hollis, 2017; Strigh, 2017; Winterhalder, 2017; Wilson, 2019). The intent of Hollis's (2017) study was to identify changes that needed to materialize to engage students in progressive learning when mobile devices are used as a learning tool. Another purpose for Hollis's (2017) research was to identify some of the methods teachers utilized using personal electronic devices in their classrooms. The above discussion manifests the many problems and the challenges that the teachers must deal with the use of mobile devices in the teaching-learning situation.

Many of the observations by researchers have identified insufficient training being a primary factor in the perceptions of these participants/educators and the tepid response to integrating personal electronic devices into the classroom (Hollis, 2017; Strigh, 2017; Winterhalder, 2017). Hollis's (2017) study verified that a more meaningful, direct, and differentiated professional development model must be provided, such a curricular integration, differentiated learning, heterogeneous grouping, and formative assessment strategies that may be prevalent in the classroom for a consistent structure (Hollis, 2017). Mobile devices are becoming a primary source when teachers are creating curriculums to support more collaborative learning (Heflin et al., 2017). The study of Heflin et al. (2017) initiated a quasi-experimental research design to investigate the effectiveness of collaborative learning with mobile devices. Heflin et al.'s (2017) study differed from that of Hollis's (2017), however, in that proper guidelines were needed not

to reduce distractions among students but to manifest a consistent mobile device use structure within the classroom. Heflin et al.'s (2017) study focused more on discovering the different types of learning groups that would help in creating on-task learning with or without mobile devices.

The development of collaborative learning was also found to be an essential factor with successful mobile device integration and improved knowledge (Chou & Block, 2019; Heflin et al., 2017; Howard & Howard, 2017). Three types of collaborative learning environments were identified in Heflin et al.'s (2017) quasi-experimental study, which included common practice, intentional practice, and Heads Up, which is a mobile app used to facilitate small group interactions in the classroom. The authors included 159 mixed gender participants who were divided into three groups using the Brame and Biel (2005) model of cooperative learning. Heflin et al. (2017) evaluated student learning with and without mobile technology by assessing the students' critical thinking, engagement, and attitude toward collaborative learning. Heflin et al. (2017) discovered that student engagement worked better through speech, eye contact, gesturing, and posture, while those not engaged were distracted by technology. The research of Heflin et al. (2017) established that teachers need to utilize different tools to foster student involved learning environments but also noted the limitations and primary functions of the tools. Even when there are strong training programs and classroom management in place, there can still be distractions that come with the integration of mobile devices in the classroom, which means that teachers must have a wide range of tools to address the many

challenges they face (Heflin et al., 2017). The teachers need to be up to date in their knowledge of technology before accomplishing the desired results in the classroom.

Teacher and Student Behaviors

Teacher and student behavior can be affected by internal and external barriers created by the adoption of mobile devices in the classroom (Heflin et al., 2017; Hernan et al., 2017; Kay et al., 2017; Mendoza et al., 2018; Selwyn et al., 2017; & Xie, Nelson, Cheng, & Jiang). Xie et al., (2021) mixed-methods study concentrated on the issue of the teachers' attitude toward technology to better understand the impact of internal and external barriers centered around self-efficacy, risk-taking, technology access, and support on their use of their technology. The study included 301 in service middle and high school teachers from 18 schools in the United States using variable and person-centered approaches for the span of two years. The results of the variable and person-centered approaches showed significant changes in external barriers and teacher behavior.

Perceived changes from the teachers were revealed in the person-centered approach. However, the external barriers significantly forecasted distinct modifications in the teacher's integration of technology, especially educational resources. Like the outcomes of the study by Hollis (2017), the confidence of integration of technology grew due to the personal practices of the teachers. Xie et al., (2021) wanted to go beyond just identifying changes in barriers and behaviors like previous studies have done. For this study Xie et al., (2021) wanted to study the longitudinal changes to detect differences and detect different groups of individuals sharing a particular attribute or are different in

character and content by using the person-centered approach. The variable centered approach was used to help define a group of quantitative analysis aimed to identify commonality between variables of interest across the entire sample and obtain single set estimates for population parameters. The study examined the changes in teachers' integration of technology across 18 different schools on a day-to-day basis. As projected, Xie et al., (2021) felt their study would not discover drastic changes in the variable-centered approach, however, the person-centered approach uncovered nuanced details. The study identified three natural distinct occurring profiles based on the teacher's belief and integration behavior. These three profiles (low, middle, and high) demonstrated shared characteristics of the teacher's belief in ability, value, and integration behaviors of educational digital resources in the classrooms (Xie et al., 2021).

When it comes to the use of technology in the classroom, a wide range of factors impact a teacher's behavior (Hanney et al., 2021). Christensen and Knezek (2017) discovered that the participants' level of risk-taking was not correlated with their use of technology within the classroom. Still, the use of technology was significantly associated with their self-efficacy and their perceived computer skills and technology access and support. Hanney et al., (2021), as with Hollis (2017), Wilson (2019), and Winterhalder (2017) found that a teacher's perception towards mobile devices had the most impact on the teacher's behavior related to the adoption of devices in the classroom. In contrast to these findings in an exploratory study, Christensen and Knezek (2017) argued that targeted professional development had the most impact on a teacher's behavior toward technology integration. There is more than the perception of the teacher that causes

distraction in the classroom and that it was teachers not feeling supported regarding the lack of specified professional development for their subject. Facing this situation could be a challenge for the teachers. In the quantitative exploratory study, Christensen and Knezek (2017) included K-12 educators from a large school district in southwestern US. Over 1430 respondents were administered a battery of instruments including the Mobile Learning Readiness Survey to measure teachers feeling prepared to teach with mobile devices in their class. This study focused on the emerging mobile learning constructs indicating whether a teacher's readiness to integrate mobile technologies into the classroom was an indicator. Even though both Winterhalder (2017) and Christensen and Knezek (2017) both feel that a teacher's perception can determine the success in innovation integration, Christensen and Knezek (2017) felt teachers who have low self-esteem regarding technology integration are the ones who are challenged with transforming their classroom and curriculum to include mobile devices.

The findings discovered by Christensen and Knezek (2017), show that mobile devices in the classroom have inherent challenges and could create more difficulties in student behavior if teachers are not equipped to integrate these devices into the classroom effectively. In a quantitative study, Gupta and Irwin's (2017) supported the view of Christensen and Knezek (2017) in a study on specific ways in which mobile devices can impact the classroom.

The research of Gupta and Irwin (2017) focused on social media and its impact on learning tasks and highlighted the need to help educators increase student engagement with their learning task from Facebook (FB) intrusion. A total of 150 participants, ages

17-28, were included in the study. To help implement better restrictions for mobile device use, Gupta and Irwin's (2017) dual-task performance study used three specific aims; distractions, stimuli, and the effect of goal-relevant interruptions on memory and comprehension to study the primary task. Students try to multitask between their assignments and social media (FB) when using their devices. The authors described three conditions to explain the intrusion that is experienced when social media is easily accessible with the use of mobile devices: (1) students purposefully attend to FB, and the lecture simultaneously, (2) students have FB open in the background but do not intend to view FB, and (3) students do not have FB open at all (Gupta & Irwin, 2017).

The authors concluded that to obtain positive learning outcomes, students would need to have strong classroom policies in place that would restrict their use of social media in the classroom (Gupta & Irwin, 2017). After discovering the change in pedagogical and technological approaches, teachers now will be challenged in gauging and managing what type of influence these innovations will have on learning within the classroom (Oliveria et al., 2019). The integration of mobile devices was discussed in previous research about improper training and guidelines. Off-task learning will be inevitable, and distractions for student engagement will be a factor with single mobile device use if proper guidelines for integration are not applied (Oliveria et al., 2019; Gupta & Irwin, 2017). Given this claim, one can imagine why teachers are apprehensive about using mobile devices (Wilson, 2019). The chance of off-task learning is compounded due to the integration of multiple types of mobile devices used simultaneously in class when

teachers are not well trained (Wilson, 2019; Hollis, 2017). The lack of sufficient training could indeed pose problems and challenges to the teachers.

The increase in a classroom management protocol will now be re-evaluated because multiple mobile devices will demand different guidelines to maintain uniformity within the classroom (Williams, 2017). The need to maintain classroom uniformity is seen mainly when the lack of accountability can lead to non-active learning, and in-class distractions create disorder with the lack of student engagement (Gupta & Irwin, 2018). The ongoing research on mobile learning indicates the area of integrating mobile devices is challenging to a teachers' pedagogy and the barriers initiated because of the use with mobile devices (e.g; Mendoza et al., 2018). With this trend of integrating mobile devices and a BYOD/BYOT model, a surprising fact is that the area of integrating multiple types of mobile devices continues to be overlooked by researchers.

Summary and Conclusions

Three significant themes materialized when reviewing the literature regarding high school teachers' concerns with using multiple types of mobile devices in the classroom for instruction. (a) *concerns for integrating mobile devices into the classroom* (Bernacki et al., 2020; Cho, 2017; Viberg et al., 2021) (b) *pedagogical challenges with the technologies* (Dias & Victor, 2017; Reichart & Mouza, 2018; Howard & Howard, 2017; Hernam, Morrison, Collins, & Kroeger, 2018; Heflin, Shewmaker, & Nguyen, 2017; Winterhalder, 2017; Chou & Block, 2019; and (c) *how to deal with barriers associated with the use of multiple types of mobile device;* (Bowman et al., 2020; Selwyn, Nemorin, Bulfin, & Johnson, 2017; Kay, Benzimra, & Li, 2017; Mendoza, Pody, Lee,

Kim, & McDonough, 2018; Diacopoulos & Crompton, 2020; Hernan, Morrison, Collins, & Kroeger, 2018; Hollis, 2017; Heflin, Shewmaker, & Nguyen, 2017; and Gupta & Irwin, 2017).

Successful integration of mobile devices in high school classrooms is critical for the success of multiple mobile devices to be accepted as a primary tool for instruction (Rogers, 2003). The balance between formal and informal learning with mobile devices will help schools figure out their implementation (Bernacki et al., 2020; Cho, 2017; Bowman et al., 2020). The balance will also guide teachers when discovering new ways to use multiple mobile devices creatively for instruction (Reichart & Mouza, 2018; Hanny et al., 2021; Howard & Howard, 2017). Figuring out how to implement multiple mobile devices will change the perception of mobile devices being a primary tool for instruction in high schools (Winterhalder, 2017; Chou & Block, 2018; Oliveria et al., 2021).

School policies must help to alleviate digital distractions so the focus on learning will help to eliminate the social pressures with social media and inappropriate device use (Dinc, 2019; Selwyn et al., 2017; Kay et al., 2017; Mendoza et al., 2018; Williams, 2017; Hernan et al., 2018). Overall, fostering guidelines and restrictions for inappropriate mobile device use will help to nurture healthier behavioral patterns with students and mobile devices which will transform the teacher's perception regarding multiple mobile device usage within the class (Hollis, 2017; Heflin et al. 2017; Gupta & Irwin, 2017).

Research continues to assess how to manage these innovations as instructional tools in the classroom. However, the information regarding the concerns of high school

teachers using multiple mobile devices in a single classroom simultaneously is still unknown. The proposed study fills the gap in the literature by expanding the knowledge regarding the concerns of high school teachers' using multiple mobile devices for instruction. Chapter 3 will discuss the methodology used to uncover the concerns of teachers using mobile devices.

Chapter 3: Research Method

The purpose of this qualitative case study was to identify the concerns of high school teachers when multiple types of mobile devices are used as educational tools and to look at how teachers cope with the barriers, challenges, and problems faced when using these technologies in the classroom. This chapter provides an explanation of the research methodology that was used in the current study. Sections include the research design and rationale; role of the researcher; methodology, which provides details of participant selection logic, instrumentation, procedures for recruitment of participants, data collection strategies, and data analysis procedures; issues of trustworthiness; and a summary.

Research Design and Rationale

The CRQ and SQs used in this study were the following:

CRQ: What are the concerns of high school teachers when faced with using multiple mobile devices for teaching and learning in the classroom?

SQ1: What pedagogical concerns do teachers face when they accommodate multiple mobile devices for teaching and learning?

SQ2: What are the resources high school teachers need to use multiple mobile devices in the classroom successfully?

SQ3: What are the viewpoints of teachers about adapting to innovations integrated into their educational culture?

SQ4: What are the barriers, problems, and challenges teachers are faced with when multiple devices are used?

The study focused on the concerns of teachers when multiple mobile devices, such as smartphones, tablets, laptops, were used in the classroom setting, and the barriers, problems, and challenges teachers faced when these devices were used in the classroom for instruction. The methodology used in this study was the case study design with the qualitative approach. According to Yin (2018), the main objective of a qualitative case study is to investigate a real-world context to understand whether the information within that phenomenon is of importance.

In this qualitative case study, detailed information about the phenomenon of use of multiple mobile devices was collected to provide an overview of how these innovations were used in the classroom by high school teachers. The purpose was to identify the real-world concerns high school teachers have about multiple mobile devices used in the classroom as an instructional tool. This was accomplished by exploring how participants in the study integrated these technologies in the classroom while finding out what barriers, problems, and challenges they faced during the process and the resources they used when integrating these technologies successfully into the students' learning.

Other methodologies were considered for the study. Quantitative methodologies were not chosen because the research questions and purpose of the study were aimed at exploring the experiences of the participants and gaining insights into perspectives associated with the barriers, problems, and challenges among the target population. Quantitative studies require that controlled conditions be measured to test a hypothesis (Apuke, 2017), which was not feasible in the present study. The mixed-methods approach was another methodology that was considered but was rejected on the basis that it

involved both quantitative and qualitative methods. Because the present study did not require quantitative methods, I decided on a qualitative design that was most suitable for my research because it enabled me to understand and explore the problem I had selected for my study.

In qualitative research, there are several other designs than the case study design. Grounded theory and phenomenology were both considered for the study. Grounded-theory methodology focuses on creating new theories from the collected data, which is appropriate when there is little information available on the phenomenon under investigation (Tie et al., 2019). This did not apply to the present study on the use of mobile devices in the classroom. The phenomenological design would have been a possible methodology for the study examining the lived experiences of research participants. However, this design was not selected because the focus was not on how the teachers experienced the use of mobile devices. The other two designs, ethnography and narrative, were rejected as not suitable for the study. The ethnographic approach concentrates on the culture of a particular group. In contrast, the narrative approach is more suited to explore the life stories of the selected individuals. In my study, the focus was on the concerns of the teachers when multiple mobile devices were used during the learning process within the classroom. The effect that these devices had in the classroom; the barriers, problems, and challenges teachers encountered when the devices were used; and the resources needed to manage these devices (see Alase, 2017) were best examined with the case study design. This design enabled me to use various strategies to collect data, as Yin (2018) had indicated, to obtain a holistic analysis of the case.

Role of the Researcher

My role as an observer–participant in the in-depth interviews involved making the participants feel comfortable, facilitating the interviews, recording their responses to the open-ended questions, and observing their body language. I did not have any personal or professional relationships with the participants. I was not an educator employed at either of the two sites, and I did not function as a supervisor to the participants. A potential bias on my part was my experience using mobile devices in a classroom setting for instructional use. I developed a protocol for the in-depth interviews so that the questions asked would not be affected by my experiences or bias. There were open-ended questions asked to mitigate possible bias that could have arisen during the interview stage. Lastly, to validate the data, I provided participants with copies of the transcripts with only their answers from the interview sessions. This allowed them to have the opportunity to affirm their words to ensure that there had been no misinterpretation on my part.

Methodology

The methodology used for the study was a qualitative case study using in-depth interviews. These interviews were conducted with open-ended questions to understand better the perceptions and concerns of teachers using multiple mobile devices for instruction. This section includes the sampling strategy and the criteria adopted for the selection of the participants; how they were identified, contacted, and recruited; and the relationship between saturation and sample size. Information about data collection instruments, how these instruments facilitated answering the research questions, data collection strategies, and analysis procedures is also provided.

Participant Selection Logic

The population selected for the study were high school teachers, Grades 9–12, who integrated multiple mobile devices in the classroom. The sampling strategy used was purposeful sampling because it allowed for the selection of participants who had experiences relevant to the phenomenon being studied (see Ishak & Bakar, 2014). The criteria for participant selection were based on high school teachers working at private Catholic high schools in Northern California who integrated multiple mobile devices into the classroom and used these devices for at least 2 years for teaching and learning purposes. The teachers were notified via email once I got the approval to administer a study using the two sites chosen. After receiving the approval, I retrieved the email list from the administrative assistance to email an invitation to the teachers specifying the selection criteria for the study. The teachers who were interested in participating notified me of their interest, and then a consent letter was emailed to them asking for their electronic ("I consent") in the email for approval. Five teachers were recruited from each site, which amounted to 10 participants for the study. Teachers from eight different subject areas represented the various subjects taught at these Catholic schools: visual arts, performing arts, English, math, science, history, theology, and foreign language. These schools had been using multiple mobile devices for instruction within the classroom for at least 2 years.

The requirement for at least 2 years of experience with multiple mobile devices in the classroom was enough time for the participants to have some experience with the mobile devices, which enabled the participants to provide relevant, authentic information.

Data saturation allowed me to identify themes in the data while allowing for specific examples to be cited from the interviews. This procedure helped me ensure meaningful information from the study about the phenomenon under investigation (see Saunders et al., 2018). I concluded that saturation was achieved by the time interviews were completed and that no new information had emerged about simultaneous use of multiple mobile devices.

Instrumentation

The in-depth interview protocol was the main instrument used for data collection. The interviews were recorded via audio recordings with prior permission obtained from the interviewees. A copy of the transcribed data from the phone interviews was provided to each of the participants to check for accuracy. To evaluate the concerns and experiences of teachers regarding the use of multiple mobile devices simultaneously, I used an interview protocol that was informed by the literature and research questions. Copies of the interview questions were made available to the participants before the sessions began to assist them in understanding and contemplating the issues to obtain more accurate and authentic information related to the research questions.

Researcher-Developed Instruments

The in-depth interview protocol shown in Table 1 outlined the questions that were used to facilitate the individual interview sessions. Teachers were able to share their experiences during the interview sessions regarding how the use of multiple mobile devices affected their pedagogy. The questions used to guide the interviews were based on the research questions and supporting literature.

Table 1

In-Depth Interview Protocol

Research question	Interview question	Stages of Concern
CRQ: What are the concerns of high school teachers when faced with the use of multiple mobile devices for teaching and learning?	The questions were chosen to focus on the teachers' concerns when mobile devices are used for teaching and learning. *Informational Stage of concern (self)* *(CRQ)* *General Codes*: • *What they Use?* • *How long they Use?* • *General Concerns* (Winterhalder, J., 2017; Hollis, A., 2017)	How long have you been using mobile technology in the classroom? Can you list the types of mobile devices used in your classroom for learning? What apps and programs do you use with mobile devices in your classroom? Can you share your concerns about mobile devices being used in your classroom for learning? What kind of training do you think you need to manage the use of multiple mobile devices in the classroom?
SQ1: What pedagogical concerns do teachers face when they accommodate the use of multiple types of mobile devices for teaching and learning?	The questions chosen focus on the *pedagogical strategies* teachers incorporated when using multiple types of mobile devices for teaching and learning. *Personal stage of concern (self)* *(SQ1)* *General Codes*: • *Changes made* • *Self-efficacy* • *Skill deficit* (Wilson, 2019; An, P., Bakker, S., & Eggen, B.,	How do multiple mobile devices influence the work you do in your classroom? How would you describe the influence multiple mobile devices have on your ability to teach students? How have multiple mobile devices changed how you approach teaching? How have multiple mobile devices changed how you create your lesson plans?

Research question	Interview question	Stages of Concern
	2017; Brenner, A. M., & Brill, Williams, 2017)	
SQ2: What are the viewpoints of teachers about adapting to innovations integrated into their educational culture?	The questions chosen focus on the *pedagogical strategies* teachers incorporated when using multiple types of mobile devices for teaching and learning. *Personal stage of concern (self)* *(SQ1)* *General Codes*: • *Experience of Use* • *Challenges Encountered* • *Lack of Training* (Bowman et al., 2020; An, P., Bakker, S., & Eggen, B., 2017; Christensen & Knezek, 2017)	What were the steps of integrating multiple mobile devices in the educational culture of your classroom? How did the integration of multiple mobile devices affect the culture of your classroom? What specific changes were made in the educational culture of your classroom after integrating multiple mobile devices into the learning?

Research question	Interview question	Stages of Concern
SQ3: What resources do high school teachers need for successful use with multiple mobile devices in the classroom?	The questions chosen to focus on the *resources* teachers use when incorporating multiple types of mobile devices in their classrooms. *Management stage of concern (SQ2)* *General Codes:* • *Training Obtained* • *Barriers* • *Resources* (Bernacki et al., 2020; Dias & Victor, 2017; Selwyn, Nemorin, Bulfin, & Johnson, 2017; Kay, Benzimra, & Li, 2017)	What management resources do you suggest using to assist when multiple mobile devices are being used in the classroom? What management resources do you use to monitor the use of multiple mobile devices in the classroom? How are these management resources helpful in addressing barriers from the use of multiple mobile devices?
SQ4: What are the barriers, problems, and challenges teachers are faced with when multiple devices are used?	The questions chosen to focus on the *barriers, problems, and challenges* teachers faced with the use of multiple mobile devices. *Consequence stage of concern (SQ2)* *General Codes*: • *Barriers from Integration* • *Distractions* • *Policies* (Gupta & Irwin, 2018; Hollis, 2017; Hanny et al., 2021; Heflin et al., 2017)	What problems with the use of multiple mobile devices did the barriers create in your classroom? How did you manage the problems that developed as a result of the barriers? What policies did you create to address the challenges you faced with the integration of multiple mobile devices? How did these policies address the challenges from the problems with the use of multiple mobile devices?

Procedures for Recruitment of Participants and Data Collection

Being employed at a northern California Bay area school like the sites within this study, I first contacted by email the administrators of both schools to see if they would be willing to allow their school to be used as a research site. They each responded via email that their school would participate. The invitation and positive responses are included in Appendix A. Since these schools were all private Catholic high schools, their administrators could approve any researcher conducting a research study wanting access to their campus and teachers for data collection. Following approval from the Walden University Institutional Review Board (IRB Number 03-23-0378895), follow up emails were sent to the administrators who agreed to allow their school to participate in the study. A copy of the approval from the IRB was included in Appendix B. After approval, administrative assistants from each site forwarded to me a list of teachers from their school for teacher participation. An email was then sent to each potential participant at the two schools for response of their participation. The required number of ten participants was selected from among those on the first-come basis as the responses were received. After selection, a consent letter was sent to those participants who agreed to participate. I did not receive more than enough participants for the study, so I did not have to inform them that they would be contacted if the need arose for them to participate later. This would have been helpful in case any of the participants dropped out of the study or data saturation was not reached after the interviews were completed.

The study requirement should be at least a total of ten participants to take part in the study so that a sufficient sample requirement was met. Forty-five-minute interviews was the next phase after consent forms were signed and returned. The in-depth interviews took place only once for each participant and lasted for 45 minutes and was recorded with the prior permission obtained from the participant. At the end of the 45-minute interview, I made the necessary arrangements with the participants about the follow-up procedure to send them copies of their interview transcripts to enable them to verify the accuracy of what they stated. In my closing statement, I thanked them for their cooperation. I did not have any participants choose to leave early. So, I did not have to thank them as well as allowing them to exit without embarrassment. There wasn't any follow-up procedure for the interviews. This would have occurred if the participants received copies of their comments so they could affirm their words and be allowed to offer any additional or afterthoughts on the phenomenon based on their experiences.

Data Analysis Plan

The interpretation of data received from the in-depth interview sessions was handled with extreme care to eliminate the potential bias that could have arisen (Stewart, D. W., Shamndasani, P. N., & Rook, D. W., 2007). The four stages *Informational, Personal, Management, and Consequence* form the basis for thematic analysis. Table 2 below outlined the questions that were used to facilitate the individual interview sessions and the four different stages each question addressed. These stages pertained to the themes that were developed during the in-depth interview sessions with the participants.

These questions were used to guide the interviews based on the research questions and supporting literature for the questions.

Table 2

Research Questions and the Four Stages of Concern

RQ's	Research Question	Stage of Concern
CRQ	What are the concerns of high school teachers when faced with the use of multiple mobile devices for teaching and learning?	Informational Stage of Concern
SQ1	What pedagogical concerns do teachers face when they accommodate the use of multiple types of mobile devices for teaching and learning?	Personal Stage of Concern
SQ2	What are the viewpoints of teachers about adapting to innovations integrated into their educational culture?	Personal Stage of Concern
SQ3	What resources do high school teachers need for successful use with multiple mobile devices in the classroom?	Management Stage of Concern
SQ4	"What are the barriers, problems, and challenges teachers are faced with when multiple devices are used?"	Consequence Stage of Concern

Following the in-depth interviews and the transcribing of the collected data, I used a thematic analysis as the instrumentation to make judgments on coding the interview session data. This allowed me to identify themes that were based on the stages of concern connected with the research questions. There was a six-step procedure used for coding, which required that I first gain familiarity with the data from the in-depth interviews. Then, I generated the initial codes from the collected data and began to identify the potential themes that emerged from my review. Following this, I started to develop the thematic connections to the identified themes selected and defined. After that, I created a final report of my findings of each selected theme (Norwell et al., 2017). The final report created used Excel to code the information from the transcripts and identified the themes that emerged during the data analysis. I documented any discrepancies, identified the cause of the difference, assessed the error, and then determined what would be the appropriate action to change it (Norwell et al., 2017).

Issues of Trustworthiness

In a qualitative case study, trustworthiness is a crucial component to support the usefulness and reliability of the findings collected and transcribed (see Hayes & Lemon, 2020). A clear indication of the overall integrity of the study should be apparent based on the scrutiny of every phase of the analysis process beginning with the preparation and organization of the materials to the reporting of results. The criteria used to confirm the trustworthiness in a case study are *credibility, dependability, transferability,* and *confirmability*.

Credibility

This criterion is essential in establishing the confidence the reader has regarding the truth of the study. The basis regarding the credibility of the study was whether the researcher conducted the research using the proper standard procedures to receive the results needed for data analysis (Hayes & Lemon, 2020). This was apparent in the in-depth interview protocol created for the current study, the purposeful sampling of the participants, to the engagement with the participants. Another fact of credibility is the preparedness of the observer-participant, the collection of data, and the results from the in-depth interview sessions.

Dependability

For this proposed study, the triangulation of the open-ended questions in the interview protocol, along with a personal journal to document the study, helped to assure the validity of the research about multiple mobile devices used for teaching and learning. Transparency within all aspects of the research contributed to ensuring dependability by continually updating the changes that occurred during the duration of this proposed study. The consistency of the findings with the collected data established the trustworthiness of the study.

Transferability

Making sure the description of the content and the assumptions are carefully described will enhance the validity of the data collected. All information obtained through the data collection will be transcribed, and the data analysis methods will be identified (see Norwell et al., 2017). In this current study, the limitations were explained

in case other researchers chose to use the data from this case study. Another way to determine the transferability is to address the assumptions that were present before the data collection so that there are high levels of transparency to provide improved trustworthiness and credibility of the study.

Confirmability

One of the main points in establishing trustworthiness is making sure the information received from the participants is credible and believable. This was done by allowing the participants to review their answers to the open-ended questions upon requests, to make sure there was no bias implemented by the researchers when transcribing the data from the in-depth interview sessions. In addition to allowing the participants to confirm the answers given, documenting the procedures by checking and rechecking the data throughout the study helped to establish the credibility of the data as well. This confirmation of the data only strengthened the confirmability of the study.

Ethical Procedures

Ethical procedures are vital to ensure the validity and credibility of the study. I obtained CITI certification of human subjects in research and abided by the guidelines of CITI, Walden IRB, and state and local regulations. Anonymity, confidentiality, and informed consent were elements to ensure that ethical procedures were a vital foundation within the research. Anonymity was established by keeping the personal records and information of all the participants safely secured. I was the only one to have access to the data, participant information, and any related files. I stored the data in a secure password-protected account, which will be held for only five years, then destroyed. This allowed

the participants to have confidence in the handling of their personal information by their shared consent. Once they read the consent form, they had an opportunity to ask any questions to ensure their understanding of their role in this study. After the consent form was duly read and understood, I requested for them to send it via email so that it ensured their ethical protection.

Summary

The chapter focused on the research methodology for the proposed study. It provided an overview of the research questions, as well as the role of the researcher. It also reviewed the proposed case study design and justification for its selection, participant selection logic, and the procedures that would be used for recruiting participants. The data collection and data analysis plan were introduced before the discussion on how trustworthiness would be achieved in the proposed study. The ethical considerations that were made to protect the confidentiality of the participants and the selected school sites were also discussed. In Chapter 4, the data collection, data analysis, and results of the study's findings were reviewed.

Chapter 4: Results

The problem addressed in this qualitative case study was high school teachers' use of multiple mobile devices for instruction in the classroom. The purpose of the case study was to identify the concerns of high school teachers when multiple types of mobile devices are used as educational tools and to look at how teachers coped with the barriers, challenges, and problems faced when using these technologies in the classroom. The review of the literature helped to formulate the following research questions that guided this study:

CRQ: What are the concerns of high school teachers when faced with using multiple mobile devices for teaching and learning in the classroom?

SQ1: What pedagogical concerns do teachers face when they accommodate multiple mobile devices for teaching and learning?

SQ2: What are the resources high school teachers need to use multiple mobile devices in the classroom successfully?

SQ3: What are the viewpoints of teachers about adapting to innovations integrated into their educational culture?

SQ4: What are the barriers, problems, and challenges teachers are faced with when multiple devices are used?

In this chapter, relevant demographic data and the analysis derived from the collected data from interviews are presented in relation to each of the research questions. The framework used to guide the interview protocol was the CBAM) Tables are used to

illustrate the results as appropriate. Finally, I conclude Chapter 4 with a summary of the main points of the research data.

Setting

The setting for this study originally included four private Catholic schools located in Northern California on the West Coast of the United States. The four sites used a BYOD model and met the selection criteria for the study. However, due to the COVID-19 pandemic, two of the schools could no longer participate. One school no longer exists due to financial struggles, and the other could not participate because they felt it would have been too much for the teachers to be involved during a year with no certainties. Because there was a change in the number of sites participating in the study, IRB had to be notified for approval. Adjustments were made within the forms before final approval. The data collected from the two sites that participated in the study were sufficient to attain data saturation. Both sites were familiar with the BYOD platform because this model had been a part of their academic infrastructure for more than 4 years. Each site experienced different innovations before settling with the use of multiple mobile devices as their most recent innovation for teaching and learning.

Demographics

The schools selected for the study were located both in the Northeast and Southwest part of California. The populations that supported these schools ranged from upper middle class to affluent communities. The age range of high school students varied from 14 to 18 years. Both Site 1 and Site 2 included five teachers who participated in the

study. The subject matter taught by these teachers included art (visual), English, history, languages, math, science, and theology.

Site 1 is a coeducational Catholic school located in Northeast California with a population of 630 students. Site 2 is also a Catholic school located in Southwest California with a population of 830 male students. Ten participants were used for the study, five from each school. The criteria adopted for the selection of the participants were that they are teaching at a private Catholic high school that uses a BYOD model. The demographic details of each participant are included in Table 3. Each of the teachers had experience using multiple mobile devices in their classroom for at least 2 years. Both sites used the BYOD model in their school.

Table 3

Demographic Details of the Participants Employed in the Study

Participant	Subject	Years of mobile device use
P1	History	11
P2	Language	11
P3	English	12
P4	History	12
P5	History	3
P6	English	8–10
P7	Art	5
P8	Science	14
P9	Spanish	5
P1	Multimedia	6–7

Data Collection

The purpose of a qualitative study is to understand real people with authentic life experiences while maintaining the richness in the meaning of the collected data (Yin, 2018). The purpose of the current qualitative case study was to identify the concerns of high school teachers when multiple types of mobile devices are used as educational tools and to look at how teachers coped with the barriers, challenges, and problems faced when using these devices in the classroom. The data collection began by identifying sites that

fostered a BYOD model and implemented multiple mobile devices in their learning infrastructure. Once these sites were identified, I contacted the administrators from these schools to get a letter of cooperation for IRB approval (see Yin, 2018). After I received IRB approval, I contacted the administrative assistant at each site for a list of teachers so I could email them the criteria, an invitation to participate (see Appendix A), and the consent form for those who wanted to be a part of the research.

I used semi-structured open-ended interview questions to elicit narrative responses from the teachers concerning the use of multiple mobile devices in the classroom (see Yin, 2018). I emailed the interview questions to the participants prior to their scheduled Zoom audio interview so they could have time to reflect on their answers for the open-ended questions (see Turner, 2010). Ten teachers participated in separate 45-minute interviews conducted in Zoom with audio only. Before I began, I reminded each participant that the interview would be audio recorded and later transcribed. I also informed each participant before the interview that a second interview would not be necessary unless there was an issue with the transcription. I collected data during the Zoom audio interview and later transcribed the data using accepted qualitative methods before the analysis.

Data Analysis

The data analysis focused on the perceptions of teachers regarding the impact of using multiple mobile devices for instruction. I began by choosing sites that implemented multiple mobile devices within their curriculum. Before I started the interviews and collected data, a priori codes were preselected based on the CBAM framework and prior

literature supporting my study of multiple mobile devices being used in the classroom. Those codes were pedagogical concerns, resources, viewpoints of teachers, and barriers, problems, and challenges. I created a participant ID for those who would participate in the study before beginning the interview process. I labeled each individual teacher as participant with the number included (i.e., P1). Data were collected using the interview protocol pertaining to the research questions. Once I transcribed the data collected, I used software to organize the codes from the transcripts for further analysis. I began my data analysis with the transcript of P1, which I imported into Delve coding software and began searching for keywords and patterns throughout each section of the transcript that pertained to the research questions.

Once I finished identifying the different codes and categories from all 10 participants, I determined that my list of words and phrases spanned 24 different codes and six categories. The four codes preselected to analyze the study were supported by the codes and categories discovered during the review of data. Those codes were pedagogical concerns, resources, viewpoints, and barriers, challenges, and problems. Table 4 presents the 24 codes, six categories, and four themes based on the data analysis.

Table 4

Codes, Categories, and Themes

Code	Category	Theme
• Engagement • Training • Collaborations • Subject	Classroom culture Self-efficacy	Pedagogical concerns
• Structure • Choices		
• Apps • Resources • Multiple screens • Tool • Types of devices • Support • Tech challenge	Integrated technology	Resources
• Control • Change • Balance • Accountability • Learning experience	Policies and guidelines Benefits of integration	Viewpoints
• Accessibility • Connectivity • Distractions • Discipline • Manageability • Monitoring	Device usage	Barriers, challenges, and problems

Pedagogical Concerns

My analysis of the interviews revealed the codes that began to surface during the transcription process from the SQ1. The theme identified after analysis was pedagogical concerns. The categories were classroom culture and self-efficacy, and the codes that helped to identify these categories and align them to the theme were training, subjects, collaborations, and engagement. The participants explained that these devices had a considerable influence on teaching and learning in the classroom. Some participants felt that due to the primary use of multiple mobile devices, student engagement had been better with the devices. P2 spoke of the benefits of multiple mobile devices on the students desire to learn: “Having the students have their own devices, they really started helping each other. Students started helping each other figure out how to do what we were asking them to do.” A lot of the devices used in the classroom were inherited based on the initiatives that schools had implemented prior to the school year.

The participants shared that they had to self-train with these devices because professional development was limited, and they did not have enough time to learn all of the devices supported for classroom use. Some participants had existing knowledge of each device used; however, they were required to do more training to address the problems that arose. P6 spoke about the frustration felt because of the constant change in devices: “I don’t have the time to maintain this kind of energy with the software, you know, in terms of creative rewriting, all my lesson plans for this new thing. ”This perception was shared by many other participants in the study.

Most of the participants also commented that the lack of training is what led to their self-efficacy regarding the different devices. Training was mentioned multiple times during the interview process by many of the participants due to the lack of preparedness they experienced with some of the devices being used and the new remote learning approach to teaching due to the global pandemic in 2020. Not all participants agreed that more training was necessary. P1 shared that training was not necessary for the use of multiple mobile devices because teachers get enough formal training. P1 added: "What sort of formal training do I need? None! It's a teacher thing and I've been doing that for 40 years now. So, it's knowing and kind of understanding where the kids are but the training thing… not necessary."

Even though some of the other participants felt training was key to the success of the devices in the classroom, there were differences regarding what type of training was needed. P2, P3, P7, and P8 felt specific training was needed to help in managing mobile devices. P3 spoke of why specific training was necessary for different aspects of multiple mobile devices usage: "As far as training, what I have generally found on the bigger systems … there seems to be a lot of support training in those programs. I would say more training within specific departments, academic departments in those apps." Other participants felt the training should have been centered on maximizing the use of these devices. P6 continued to speak on the support teachers need to be successful with multiple devices and a more learner-centered environment: "So whatever content management software needs to be used, it needs to be known by the teachers. And I really focus on the relevance of the devices which is why you need to know the device."

One form of training shared among the participants was peer training. Teachers who taught the same discipline helped each other with selecting apps, software, or guidelines regarding planning or curriculum issues. The codes subject and collaborations were selected because the participants shared experiences with training. Even though many of the participants were apprehensive with the barrage of innovations, not all participants were opposed to the use of multiple mobile devices.

Some participants felt that student learning had been better due to the use of multiple mobile devices. The code engagement was created based on this data analysis. All 10 participants spoke about their school investing in a learning management system (LMS) to help all stakeholders invested in the students be cohesive with the information received to ensure learning in the classrooms. This approach was supported by the participants because it helped them continue to manage the learning based on the confidence they felt in teaching with these devices. Because the innovations were becoming a primary tool for learning and teaching, finding a system to ease some of the stress with using these devices was the key to the process.

The participants found the need for engagement was priority when the global pandemic affected education. P9 spoke of being more creative with curriculum to keep students engaged: “Trying to appeal to different students’ interests, different competitions levels or interests in general. They can see my account and try and compete with me.”

Engagement with learning was already a challenge as discussed by P10. Now with kids learning remotely, many of the participants shared their fear of losing the students engagement because they were unable to walk physically to do a check in with

the students. P10 spoke about one site including a new protocol addressing just that concern: “We were concerned about engagement. We had a school policy that kids had to have their cameras on when they were remote. When I started implementing, I started to see the value of the mobile devices as a secondary screen. The students became a little more self-directed and self-motivated in their learning.”

Each participant shared the concern regarding engagement and minimize any distractions to the students learning. P4 discussed the teachers understanding of where education was going and how urgent it was for teachers to include new aspects of teaching and learning with the use of multiple mobile devices into their curriculum: “I would say more than anything, we live in a digital world, and you must engage in it as best you can. You must look for the opportunities and how to effectively engage students. I think that the mobile devices that are in the classroom, can really empower students in ways that education and in classroom education instruction did not do beforehand.”

Resources

The data analysis shifted from pedagogical concerns to the resources based on the information regarding support to help maintain use with these multiple devices. The second research question dealt with the resources teachers suggested when multiple mobile devices are used in the classroom successfully. The theme was Resources and the category that evolved from the analysis was Integrated Technology. There were a multitude of codes that emerged during the interview related to the theme resources and category integrated technology used by teachers with multiple mobile devices. Those codes were types of devices, apps, programs, tools, and support. The participants shared

that at least three to five different devices were used in their classroom daily. The two sites participated in the study all used Apple devices and were supported by Apple. However, both sites participated in the study allowed students to eventually bring in whatever devices they had. P1 discussed the types of devices that were used in the classroom: “I checked, and we have about everything, so the boys can use their apple and android phones. We have Macs and all sorts of PC’s, and Chromebooks. We have a mishmash of just about everything.”

Participants continued to discuss the types of devices as well as the apps and programs used for teaching and learning. These various apps and programs allowed me to formulate the next set of codes that I established based on the answers provided by some of the participants. For instance, all 10 participants spoke about their school investing in Google Workspace as their primary learning management system (LMS). Each site grandfathered devices and with each device more training and support was needed for teachers to maximize the support acquired. P1 explained why the selected LMS made sense to invest into their classrooms: “We are a Google school. We use Google suite which is now called Google Workplace for education, Chrome, Docs and Google presentation. We also use Spreadsheet, Google Draw, Google sites and a lot of Google products.”

Many more codes emerged that pertained to the resources needed to support the pedagogical concerns teachers faced when they accommodated multiple mobile devices for teaching and learning. Not everyone was on board in the beginning for Google to be the chosen LMS. Some teachers felt changing to this system as the primary source would

be a mistake. However, after the use of this LMS, participants began to alter their thinking on allowing it to become a good resource for both teaching and learning. P6 spoke about the apprehension regarding the system in the beginning, “And so I thought that even though it takes longer to grade in Google classroom, it’s a better grading experience and it’s a better instructional tool for the kids.”

The next code selected during analysis was the word *tool*. The participants revealed that overall, the different resources used helped in creating a one-stop shop for all those involved in the student’s academic progression. P9 disclosed how these tools helped in supporting the students: “But we’re there and being able to show the entire screen and walk the parents through exactly what I’m doing in the classroom, exactly what the resources are a digital list of resources where everything is hyperlinked, and they can access everything that we do in the classroom. All the information, a video introduction of myself, the digital letter, a You Tube page where I post important videos for them to know how to do certain things.”

Viewpoints

The third research question is “What are the viewpoints of teachers about adapting to innovations integrated into their educational curriculum?” The theme was Viewpoints, and the categories were policy and benefits of integration. The codes that evolved from these categories were accountability, balance, control, change and influences, invested, learning experience.

Participants in the study continued to express how they were beginning to see the benefits of integration with multiple mobile devices. However, they needed to make sure

students were held responsible for their learning with their use of multiple mobile devices. Accountability was one of the first codes for the category Benefits of Integration. P4 alluded to that point during the interview: “Because of technology, mobile devices availability really shifts a lot of the potential for student engagement. Students begin to own their own learning in many ways.” Another example is how teachers respond to the written work submitted by students. P3 highlighted the advantages of integrating multiple mobile devices into the learning: “Technology is a benefit that comes with a price for sure. However, it improved the way that I make comments because I can neatly type a pretty well written note or a comment to a student.” P3 added: “When I was doing it with a pen, I was constantly trying to abbreviate as much as possible because my writing might get sloppy after grading for three or four hours. So, it has really revolutionized how I grade papers.”

The viewpoints of the participants elaborated on other code words like the *control* and the *learning experience* of the students. P5, P6, and P8 all shared their experiences with multiple mobile devices and more specifically the learning experience which included the control of the devices. P5 shared how control is done through balance not the use of multiple devices: “Every second, we would use it, but it wouldn’t have to be every single second. We would use it when it was necessary or when it would really enrich the experience more.”

A shared response of all the participants is the variety of options multiple mobile devices can offer if integrated properly. Many of the participants shared their observation of the advancement technology and mobile devices brought to education. P3 stated: “I

don't know how we would have done this 10 years ago without all these opportunities online. Being able to look up random videos at any time or look up random facts that somebody asks about at any time is really kind of a god send in the middle of class."

The next set of codes were related to the category *Benefits of Integration*. This category expounded on the aspect *policy* and the codes discovered that dealt with *policy.* P6 expressed in the interview about control and how important and pertinent it is for students to understand this: "Yeah, I can focus on Google classroom in this instance, I think that was probably the most useful software or, you know, whatever I used this year to manage the content in content and the flow of student content." There were some discrepancies regarding policy and how each site should approach it. P1, P3, P4, and P5 felt no formal policies were needed for multiple mobile devices used at their site and the policy in place for mobile devices at their site was good enough to implement multiple mobile device use. P4 spoke about perception of policy and guidelines: "There is a strong behavioral policy which really supports the teacher and instruction so that they can collect those devices. Whether it's a first offense, second offense, on and on. They've been very supportive and mindful about that. That's been good!"

The approach to teaching and learning changed for both sites based on the implementation of mobile devices as well as, a global pandemic, which many of the participants felt encouraged the decision of multiple mobile devices now becoming a primary tool for education. As reluctant as many of the participants were in the beginning integrating multiple devices in their curriculum, some had a change of heart due to the outcomes they witnessed. P3, P6, and P10's site felt stricter policies were needed to be

put in place. An example of what P6 had to say regarding policy efforts based on their sites reaction: “We set up policies where if they (the student) even looked at the iPad wrong, they were in trouble.” Both sites had policies in place to deal with cyber discipline but as time went by, the sites relaxed regarding their policy of multiple mobile devices. P6 adds: “They really relaxed as time went on and students started bringing other devices. They started requiring that all students have iPads and that’s just because the instructors are going to use an app that works on the iPad. The effort was there to incorporate these new policies but at the end these policies later fell off and the mandate to uphold them later softened over time.”

The lack of follow through from each participating site with the mandate was due to the inconsistency of issuing a punishment because of the global pandemic where cyber discipline mandates became too difficult for schools to maintain. Due to this shared result from the two sites and the 10 participants, this nullified the discrepancy of policy being an issue for my study because eventually participants continued to use the resources in place for mobile devices.

Barriers, Problems, and Challenges

The last research question was “what are the barriers, problems, and challenges they are faced with when multiple devices are used?” Barriers, problems, and challenges were evident throughout the data analyzed from the transcriptions of the interviews. These participants shared their challenges and concerns that teachers had due to the implementation of multiple mobile devices which set the foundation for the theme Barriers, Challenges, and Problems. The codes discovered during the interview process

for this theme were *Accessibility, Connectivity, Distractions, Discipline, Manageability* and *Monitoring.* The category created based on those codes was *Device Usage*. Even though the participants agreed to the benefits of multiple mobile devices and how these innovations continue to change education, the concern for mobile devices were magnified because more than one device was being used in the classroom for instruction. Participants spoke about the challenges of the devices and the platforms needed to be used with these innovations. The code word accessibility was expressed by many of the participants.

P9, P8, and P5 dealt with specific issues that focused on accessibility in their interviews. P9 elaborated on how accessibility created concern with multiple mobile devices used due to limited resources: “You know not all the kids have all the applications or all of the physical things that the device needs to access everything all the time.”

P8 discussed the accessibility when students had to deal with limited space during a pandemic education: “They [students] had other family members in the same rooms, and things that just wouldn’t be a problem if we were in person are now preventing them from accessing the same education.” P5 speaks about accessibility when kids have limited resources or access and it creates mental and social anxiety:

> Accessibility to devices shows the gap within wealth or socioeconomic status between the students and their families. It can become a problem because some kids are like I don’t feel comfortable in this classroom, or I don’t feel comfortable at school. I don’t feel worthy which I think is something that we’ve seen as a

> major aspect in education and schools that kids really do rely on the social aspect of it. Feeling worthy and loved and wanted at their school is huge for them to be successful in the classroom.

The next code word *connectivity* aligned with what the participants shared about accessibility. The overlapping between limited access to devices and connection was based on the economical limitations with some of the students even at the two private catholic school sites. P8 shared a concern that speaks about both the accessibility and connectivity:

> I have kids that always have problems with wi-fi and video. However, now that we are in distance learning, even at a private school, there are kids that have much more difficulty being online for other classes than other kids.

P8 continued

> when the kids are using their own stuff, then obviously, there's a lot of economic barriers, because you don't want to be doing anything where some of the kids are going to have access to technology the other kids will not.

P9 echoed that same concern with accessibility and connectivity especially during the pandemic year: "I think the biggest issues were internet connectivity, obviously at home. Not everybody's internet is the same you know. Some households don't necessarily pay for Internet and real data. If anything, do they even have internet at home?"

During the pandemic, a lot of concerns were shared about not being able to see the kids in person. Participants also discussed concerns with returning to traditional

practices from a paperless approach to learning. Since that was the case for the two sites, *Distractions* and *Disciplines* were other code words discussed for the category *Device Usage*. Participants discussed how their approach to pedagogy needed to change regarding students off-task learning when using multiple mobile devices. P10 spoke on distractions and how students shared the way they took advantage of how easy it was to go online: “Even they themselves have told me it was very hard for them to focus. I think across the board, all of them said or have expressed to me at some point in time, they were doing something else instead of paying attention to the class.”

The distractions weren’t just disciplinary reasons. Some of the participants discussed issues related to troubleshooting and the teacher’s lack of understanding the device being used due to not having that device. P8 spoke on how teachers lack knowledge could be a distraction as well: “You need to have the device or the program to know how to use it and tell the students about that particular software, program or device.”

Other aspects of distractions dealt with an overabundance of unnecessary resources that some of the participants discussed. P5 shared how multiple mobile devices can be daunting at times for learning and teaching: “Sometimes it feels like we’re shown 5000 things, which is, great, because we have 5000 options, but then that becomes overwhelming, and it can push a lot of people off from even trying it.”

Regarding the code word *Manageability*, some participants expressed how kids are affected by some managing challenges as well. P4 shared a concern for the challenge of managing assessments that occur with multiple mobile devices and pedagogy: “And so

I think always trying to find and build authentic assessments in a digital world is going to continue to be a challenge when they're not sitting in our class writing out an essay with a pen and paper. They do sometimes look for ways to take shortcuts to be able to get the work in on time; oftentimes students are juggling multiple courses."

During the pandemic, a lot of these concerns were shared about not being able to see the kids in person, so adaptability for the teachers was something they needed to include in their daily routine. When the participants wrapped up their interview, many of them ended by speaking on how imperative it is that we teach our kids how to use mobile devices properly and how to maximize the use of these innovations because they will have to compete on the global stage.

Evidence of Trustworthiness

I used persistent observation once I reviewed data from the in-depth interviews of each participant. Their experiences and answers to each question helped me probe deeper into their statements which allowed me to receive a larger view of their perceptions connecting to the barriers, problems and challenges they had for the use of multiple mobile devices for instruction in their classrooms. The consistency of the findings with the collected data established the trustworthiness of the study. To determine trustworthiness, these four criteria points had to be established when analyzing the information: *Credibility, Transferability, Dependability,* and *Confirmability.*

Credibility

The basis regarding the credibility of the study was whether the researcher conducted the research using the proper standard procedures to receive the results needed

for data analysis (Connelly, 2016). This is apparent in my study in the in-depth interview protocol created and the purposeful sampling of the participants. Another fact of credibility is the preparedness of the researcher, the collection of data, and the analysis of the results from the in-depth interview sessions. The scheduling of interviews and sending the questions to the participants after we set a time for their in-depth interview increased the credibility of the data because it afforded them time to reflect and record their answers before sharing them with me. This criterion was essential in establishing the confidence the reader has regarding the trustworthiness of the study.

Transferability

Making sure the description of the content and the assumptions were carefully described enhanced the validity of the data collected. All information obtained through the data collection was transcribed, and the data analysis methods were identified (Norwell et al., 2017). In this qualitative study, the limitations were explained in case other researchers chose to use the data from this case study. Another way to determine the transferability is to address the assumptions that were presented before the data collection so that there were high levels of transparency that provided improved trustworthiness and credibility of the study. Transparency within all aspects of the research contributes to ensuring dependability by continually updating the changes that occurred during the duration of this study.

Dependability

The steps taken to ensure the data collected was credible was staying aligned with IRB guidelines as well as, using the CBAM model to help in forming the interview

protocol used in each interview performed. For this proposed study, the triangulation of the open-ended questions in the interview protocol, along with a set scheduled interview times with time allotted for the preparation for the participants, helped to assure the validity of the research about multiple mobile devices used for teaching and learning.

I constantly read the data to examine the characteristics of the data making sure the concepts aligned with the categories and themes preselected due to the SoC (see Korstjens & Moser 2018). Dependability was also established due to the in-depth steps shared within the analysis of the study showing how the perceptions of each participant supported the purpose of the study (see Yin, 2018).

Confirmability

One of the main points in establishing trustworthiness was making sure the information received from the participants was credible and believable. This was done by allowing the participants to review their answers to the open-ended questions upon requests, to make sure there was no bias implemented by the researcher when transcribing the data from the in-depth interview sessions. In addition, Korstjens & Moser (2018) state that allowing the participants to confirm the answers given, documenting the procedures by checking and rechecking the data throughout the study helped to establish the credibility of the data as well. The confirmation of the data only strengthened the confirmability of the study.

Results

The findings were used to provide insight into the teacher's perceptions and experiences regarding the concerns of high school teachers when faced with using

multiple mobile devices for teaching and learning in the classroom. The results are presented for each of the four research sub questions.

SQ1

SRQ1 dealt with the basic information about the pedagogical strategies teachers incorporated when using multiple mobile devices for teaching and learning. Changes were made due to the integration of multiple mobile devices within the participants approach to instructions. There were two major areas evident by the data collected regarding pedagogical concerns: *Classroom culture* and *self-efficacy*. Since the implementation of multiple mobile devices, teachers constantly reevaluated their approach to traditional strategies of teaching and contemplated if the standard model was still engaging for the students. One of the many changes that has taken place in the classroom was the transition from traditional methods of conducting school business to using more of a digital footprint for everyday activity. This increased because of multiple mobile devices as well as the effects of the COVID pandemic.

Classroom culture relates to the shift in teachers' approach to instruction, lesson planning and training that was needed due to the devices integrated into the classroom. P4 stated: "We live in a digital world, and you have to engage it as best you can see. You look for opportunities like how to effectively engage the students. I think that the mobile devices that are in the classroom can empower students in ways that education and in classroom education instruction didn't do beforehand."

The limitations with the use of multiple mobile devices revealed the lack of *self-efficacy* many of them had with certain devices used in the classroom. Self-efficacy was

an important factor especially when teachers needed to trouble shoot the devices in the classroom which ranged from device malfunction to accessibility or connectivity issues. For teachers to manage a successful classroom with multiple mobile devices, training was a necessity that was highlighted during data analysis. Teachers had to adopt different methods of training to get the experience and knowledge they needed for devices used in their classrooms. Teachers discovered various ways of training for using these multiple mobile devices, such as, standard professional development training methods, online self-training videos, and collaboration with other colleagues.

These were the main sources teachers found useful in the time span needed for the understanding of multiple devices used in their classrooms. P7 elaborated on self-training: “Just generally speaking the way I kind of trained myself I went online and looked things up to learn it.” Teachers realized they had to change their mindset regarding multiple mobile devices used as a primary tool because the classroom and education was rapidly changing. Especially since the pandemic, going back to the traditional way of teaching became more difficult to do.

SQ2

SRQ2 dealt with the basic information about the resources needed when using multiple mobile devices in the classroom. There was one major factor evident by the data collected regarding Resources: *Integrated Technology*. The grandfathering of technology eventually led to the school wide decision to use the BYOD model. Teachers realized they now had to adopt a new system to successfully manage their classroom. Implementing a Learning Management System (LMS) was the universal approach for

both sites when using multiple mobile devices. Google Workplace was the common LMS used because it allowed different platforms, devices, and operating systems to all be in sync. Both sites encouraged their teachers to implement other resources in addition to the LMS chosen by each site since they knew their subject matter and what was best for it.

Due to the constant changes in technology, there were plenty of resources available for teachers. However, it was up to the teachers to research and find the training needed to maximize the use of the apps and devices within their classroom. P9 spoke on some of the resources acquired since the change in approach with instruction: “There is a plethora of websites and apps like an overwhelming amount. I think I had to try and stay as basic as possible, but still, you now can access things like Flipgrid or Duolingo. This engaged the students in a way that was a little bit friendlier. I’m trying to appeal to different students’ interests, different competition levels or interests in general.”

SQ3

SRQ3 dealt with the basic information about the viewpoints of teachers when dealing with multiple mobile devices that are used in the classroom. There were two major areas evident by the data collected regarding Viewpoints: *Policies and Guidelines and Benefits of Integration*. Teachers understood managing a classroom was key to on task learning. Making sure the students were accountable in many ways was a factor in creating policies and guidelines for mobile devices. The guidelines and policies in place were still prevalent for both sites but additional policies were added due to multiple devices used in a class plus a global pandemic. Not all the participants felt this way about not needing a policy to help teachers maintain on-task learning when the use of multiple

mobile devices were in the classroom for instruction. Some of the participants felt that the policies in place did address some of the challenges created from the use of multiple mobile devices. They agreed that all the challenges were not met but each participant focused on some of their key areas of concern whether the polices did in fact, help alleviate or at least, addressed the issue in some way.

Due to this complication, these sites went above and beyond to help meet the needs of integrating multiple mobile devices in the classrooms as best as possible for the participants. P2 shared their school goes above and beyond to make sure enough resources are given to the teachers and for the teachers to constantly ask for professional development or training when needed: “Luckily in our school we have a culture of investing in technology, investing and quite a bit of support and collaborating. We have a lot of collaborative teams. It is cross curricular and it’s very encouraging and supportive.”

The teachers did not necessarily agree on which or if the policies addressed the challenges created by the problems with the integration of multiple mobile devices. However, there were no discrepancies because each teacher felt policies implemented by their school or their own personal policies implemented, did meet the need of the specific challenges created because of multiple mobile device integration.

Even though there were concerns regarding the use of multiple mobile devices, teachers still felt there were many benefits to the integration of these devices. P10 alluded to the change in students’ perception of education with the multiple mobile devices: “But when I started implementing, I started to see the value of the mobile devices as a secondary screen for the students. They were more self-directed, and self-motivated in

their learning." Teachers were beginning to buy into the benefits of integrating multiple mobile devices. Measuring both the pros and cons of these innovations, teachers saw more of the pros to the addition of these devices. Tracking of homework assignments, collaborations for projects, self-directed learning, interactive learning, and student empowerment were just a few be. These factors allowed students to be accountable for their own learning experience which helped implement a social change to education and the classroom.

Regardless of the benefits these devices brought to the classroom and curriculum, the struggle of teachers making sure these devices could be implemented in the workflow of their classes as well as, keep students engaged to lessen the disciplinary actions was a major concern from both sites and all participants.

SQ4

SRQ4 dealt with the basic information about the barriers, problems, and challenges teachers faced when multiple mobile devices were used. There was one major category evident by the data collected regarding barriers, problems, and challenges: *Device Usage.* The increase in demand for the use of multiple mobile devices as a primary tool caused alarm amongst teachers.

Consistency of devices was a common problem when using them as a tool for instruction. Not every student had the most recent version of the device. This inconsistency led to issues of connectivity and accessibility. As a result, students missed out on assignments and fell behind in class. P9 spoke to the frustration regarding students not having full access to software or applications while in class: "And like I said, not all

the kids have all the applications or all of the physical things that the device needs to access everything all of the time. Sometimes they might need permission from their parents."

Summary

The purpose of this study was to understand the perceptions and lived experiences of teachers who implemented multiple mobile devices into their learning. The research investigated how multiple mobile devices impacted the pedagogical concerns and the classroom cultural transformation experienced and perceived by the participants. The data collected acknowledged and supported the types of resources the participants expressed were beneficial in helping sustain on-task learning and better student engagement. The data added further acknowledgement based on the participants experienced viewpoint which highlights the pros and cons of multiple device implementation in the classroom. Furthermore, the research investigated how multiple mobile devices impacted instruction and what barriers, challenges, and problems occurred with the use of these innovations for instruction. In Chapter 4, I described the results of the study and in chapter 5, I discuss the meaning of those results.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this qualitative case study was to identify the concerns of high school teachers regarding the use of multiple types of mobile devices as educational tools and to look at how teachers coped with the barriers, challenges, and problems faced when these technologies are used in the classroom. The intent was to discover what helped teachers manage multiple mobile devices used in a BYOD program. This study may help other educators understand the complexity of integrating multiple mobile devices in their classroom for instruction and learning as well as manage these innovations. The participants reported that incorporating multiple mobile devices created a more engaged learning environment allowing students to be more collaborative and accountable in their learning, which supported the transformation of education during a global pandemic (see McClung, 2019).

Interpretation of the Findings

For each research question, I explain ways the results of this study confirm, disconfirm, or extend knowledge in the discipline of educational technology based on the findings in the literature. Additionally, I analyze and interpret the findings in the context of conceptual framework using Hall and Hord's (2011) CBAM for this case study.

SQ1

The findings of this study confirm, disconfirm, and extend what was found in the current literature. Some of the pedagogical concerns shared from participants in my study focused on classroom culture and self-efficacy. The participants stated that students were more engaged because they were more familiar with using their own devices. Participants

in Chen and Kizilcec's (2020) study also expressed that student were more creative, more collaborative with their peers, and more engaged in the classroom.

Self-efficacy was a concern because teachers lacked the professional development that provides the knowledge of how to support the use of multiple devices for instruction. Hanny et Al. (2021) confirmed the importance of professional development by stating that if teachers integrate different mobile devices into the classroom, they need to have sufficient educational platforms, apps, and proper training to ensure the transition from the traditional to digital approach to teaching. Even though participants from both studies agreed with the importance of teacher self-efficacy, my study extends the knowledge that there is a steep learning curve to knowing how to support multiple devices compared the use of a single device.

SQ2

The importance of teachers discovering resources to maximize each device for on-task learning for their students was imperative. According to Reichart and Mouza (2018), there was a benefit to investing in resources and time to properly train teachers on how to integrate these devices and platforms into the classroom. The participants in their study took 4 years to integrate the one-to-one initiative for the iPad into the classroom. Although my participants agreed with the importance of investing in resources, they lacked the time to conduct in-depth research to identify the best resources to support the use of multiple devices in the classroom. Some of my participants were able to discover a solution of integrating a universal LMS. Participants from my study stated that investing

in a good LMS helped to relieve the pressure of not having a unified platform for students with different devices, allowing for more collaboration, communication, and learning.

SQ3

Gupta and Irwin (2017) concluded that to obtain positive learning outcomes, students need to have strong classroom policies in place that restrict their use of social media in the classroom. Hernan et al. (2018) stated that off-task learning would be inevitable and distractions for student engagement would be a factor with single-mobile device use if proper guidelines were not in place. My participants supported these viewpoints. My participants expressed the benefit of having a clear policy in place that would help maintain an active learning environment by keeping students accountable for their learning. My participants further emphasized that teachers must enforce these policies early on to foster student accountability with on-task learning and to sustain a manageable classroom for multiple mobile devices. Participants from both studies confirmed that students being accountable for their learning will help mitigate distractions that lead to off-task learning. Accountable student learning will help create social change in education.

SQ4

The participants discussed the barriers, problems, and challenges they faced daily when accommodating multiple mobile devices in the classroom before and during the pandemic. Hanny et al.'s (2021) participants reported that due to the problems with integration of technology, the lack of confidence in teachers with mobile devices can lead students to be distracted and not engaged in the classroom for learning. Hanny et al.'s

(2021) participants focused more on the cause for the problems of behavior due to the integration rather than the device. My participants also expressed concerns with the barriers of accessibility and connectivity. For example, students who had outdated devices struggled with connecting to the school Wi-Fi, and teachers lacked the appropriate resources to troubleshoot when students had problems with their devices. Due to teachers not being able to troubleshoot each device in the classroom, teachers could not manage the class as needed. Furthermore, participants in my study felt multiple mobile devices were difficult to use to maintain on-task learning. Gupta and Irwin (2017) found that students tried to multitask between their assignments and social media when using their devices. My study confirmed that the absence of a universal monitoring system made it more difficult for teachers to manage behavioral problems when students used multiple devices in the classroom.

Limitations of the Study

The teachers who participated in this study taught at a site that uses a BYOD model and multiple mobile devices in classrooms. Each participant met the selection criteria for this study. Even though the teachers worked at sites that use a BYOD model and multiple mobile devices, the simultaneous use of multiple mobile devices was a key criterion for this study. This study had some limitations as part of the purposeful sampling. The sample size was only 10 participants (five per site) at two designated private Catholic high schools in California. Despite the fact the selection allowed for different subjects taught in private high schools, there was limited representation from the selection of teachers.

The risk of using a limited number of participants was evident in the perceptions regarding the experience of teachers in the different subjects with the use of multiple mobile devices. Given that control selection was not applied, theology and performing arts were not represented among the 10 participants. As a result of these two subjects not being represented, perception and experience using multiple mobile devices in these classroom settings were missing, and the understanding of how these innovations could affect those types of classrooms was absent.

Potential bias was another concern in the study because of my experience with multiple mobile devices in the classroom. This bias was mitigated using an interview protocol and open-ended questions presented to the participants prior to their scheduled interview. This promoted a neutral stance for me as observer–participant so personal bias would not be an issue in collecting or analyzing the data.

Recommendations

This study began initiated a needed conversation regarding the use of multiple mobile devices in high school classrooms. Understanding the concerns associated with these devices may promote continued conversation regarding how to improve the implementation of multiple devices in the curriculum and classroom culture. Recommendations for further research in this area would be another CBAM study including a larger number of schools and both public and private schools to explore the challenges of connectivity, accessibility, and distractions among students and teachers.

Implications

Mobile devices had been used in the classroom prior to the COVID-19 pandemic, but multiple mobile devices became a primary tool for education at the two study sites. This advancement allowed for more apps, software, and advanced devices to be used for teaching and learning. Education moved from a traditional teacher-centered model, with tools such as chalkboards, physical books, pens, and pads, to a nontraditional approach in which teaching, and learning were occurring digitally and online. The barriers, problems, and challenges associated with these innovations were explored to determine whether the issues were sufficient to keep these devices out of the classroom. The current study addressed this transition in learning and teaching by exploring the relevance and efficacy of using multiple mobile devices in the classroom. This study may encourage more in-depth conversation about how the use of multiple mobile devices could revolutionize the classroom for positive social change by fostering a culture that prepares students to be accountable for their learning and prepares them to be leaders.

Conclusion

The participants in the study addressed the need for better resources to be offered so multiple mobile devices could be beneficial for teachers in the classroom for teaching and learning. Participants reported many concerns such as off-task learning, disengagement, accessibility, connectivity, and change in classroom culture that should be addressed prior to integration to promote a more manageable and cohesive learning environment. Professional development for teachers pertaining to multiple mobile device use should also be something schools invest in, so a teacher’s knowledge of these devices

is more developed. Investment in teachers' experience and knowledge of multiple mobile devices would help to minimize concerns, problems, and issues that may arise. Implementing policies and guidelines specific to multiple mobile device use may increase accountable learning among students. The current study could catalyze the transformation of education by encouraging the use of technology and allow students to compete on a global level. This may foster social change in the classroom, community, and society.

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Appendix A: Letter of Cooperation and Email Responses

Hello Administrators,

My name is Orin Carpenter, and I am the Art Department Chair at Marin Catholic High School. I am currently in the research phase for my PhD program at Walden University. I am researching schools that use multiple mobile devices in their classrooms for educational purposes and have been using these devices for at least 2 years minimum. If you could let me know if your school fits the criteria and if it is ok for me to reach out to you to discuss my research any further, it would be greatly appreciated.

Thanks,

Orin Carpenter
Art Department Chair,
Marin Catholic High School

Appendix B: Recruitment Flyer

Study on multiple mobile devices used in a classroom seeks Northern California Catholic high school teachers to participate

There is a new study called *"High school teachers concerns with the use multiple mobile devices in the classroom"* that could help understand the concerns teachers have when multiple mobile devices are used for learning and teaching. For this study, you are invited to share your experiences via with these technologies in your classroom and how they impact your pedagogy. This interview will be audio recorded. Teachers invited to participate are from Catholic High Schools in Northern California. These schools are the only schools participating because these schools allow multiple mobile devices in their classrooms for teaching and instruction. This interview is part of the doctoral study for Orin Carpenter, a Ph.D. student at Walden University.

About the study:

- One 45–60-minute individual in-depth interview
- Interview will be audio recorded only via teleconference!!!
- To protect your privacy, personal information will be for contact only
- Personal information will not be shared.
- On consent, participants are asked to keep confidentiality as well regarding all aspects of the study

Volunteers must meet these requirements:

- High School teacher for at least 2 years consecutive
- Experience with mobile devices (in the classroom)
- Currently employed with a Catholic high school in Northern California
- Be available to participate in a teleconference interview that will take no more than 45-60 minutes to conduct
- Provide your contact information so an interview may be scheduled

- Permit the teleconferencing interview to be recorded
- Provide feedback (if applicable) to researcher regarding any interview response discrepancies or confirm accuracy within 1 week of receiving interview summary.

If you are interested, please email Orin Carpenter at orin.carpenter@waldenu.edu.