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An Investigation of Case-Based Instruction with Feedback in a Research Methods Module

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AN INVESTIGATION OF CASE-BASED INSTRUCTION WITH FEEDBACK IN A RESEARCH METHODS MODULE

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ABSTRACT

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Case-based instruction (CBI) is a strategy that has shown positive outcomes for promoting learner engagement, improving attitudes toward instruction, and increasing measures of learning. Research methods courses are an area for which CBI may effectively improve learning performance and attitudes. Studies have shown that research methods is a topic that students often find especially difficult and stressful.

The purpose of this study was to investigate whether students who received online CBI with feedback would score higher on a posttest and satisfaction questionnaire, compared to students who received the same CBI without feedback. The sample used for this study included students that were enrolled in a psychology graduate course in research methods; an interdisciplinary graduate course in educational research methods; and an undergraduate course in educational technology. The independent variable was online case-based instruction, with two levels: with feedback, and without feedback. The dependent variables were student knowledge performance, and student satisfaction. Student knowledge performance was measured by a multiple-choice posttest, and student satisfaction was measured by a 11-item questionnaire.

The data were analyzed using analysis of covariance (ANCOVA) for performance and analysis of variance (ANOVA) for satisfaction, with the alpha level set at .05. No statistically significant differences were found for test performance nor satisfaction with the instruction. Given this finding of no statistically significant differences, follow-up analyses were conducted on categories of question topics (independent/dependent variables; experimental/non-experimental research designs; and causation). No statistically significant differences were found when results were examined by question topic. Further follow-up analyses were conducted on question topic categories for each of the three courses in the study. No statistically significant differences were found in the psychology and research methods courses. The sample size for the educational technology course was not large enough for statistical analysis.

Several factors may have contributed to this finding of no statistically significant difference. These factors include preexisting knowledge and insufficient difference between the control and treatment conditions. Further research is suggested, including investigation of the effects of CBI with feedback on reflective thinking, and the enhanced use of multimedia to deliver CBI.

CHAPTER I

INTRODUCTION

The case-based method, often referred to as case-based instruction (CBI) and alternately as case-based learning (CBL), is used to develop learners' problem-solving skills in complex and ill-structured contexts (Jonassen & Hernandez-Serrano, 2002). CBI has a long history of practice in many disciplines including law, business, medicine, and teacher education (Williams, 1992). Although case studies are often used for teaching in these course areas, it is an emerging trend for some social science disciplines. Thus, teachers vary in their familiarity with case studies in instruction (Salmons, 2014).

Case-based instruction (CBI) is a type of meaningful learning in which students acquire authentic knowledge and skills and then use them to answer questions and construct solutions in and out of their learning environments (Wilson et al., 2002). Hmelo-Silver (2004) described CBI as a problem-based learning approach in which learners are required to actively participate in the learning process by working though authentic situations. The case-based method has been widely used in a variety of fields and requires learners to actively participate in the analysis of real or hypothetical problem scenarios that portray the type of situation that can be expected to naturally occur in the discipline under study (Ertmer & Russell, 1995). The courses used in this study represent

contexts where case-based instruction could be effective in enhancing students' learning as well as their engagement and motivation in regard to the instruction.

Use of Case Studies in Instruction

The terms case-based method, case-based instruction, or CBI are often vaguely noted in the literature without a specific definition of how they are applied in practice. As a result, many studies that investigated the effectiveness of CBI did not provide sufficient explanations of why the intervention under study was a good application of the case-based method. As Dooley and Skinner (1977) pointed out, "the phrase 'case method' embraces such an array of pedagogic practice that the term itself has no precise connotation. There are as many varieties of the case method as there are practitioners" (p.277). In other words, there are different ways of utilizing cases for pedagogical purposes.

Stolovitch and Keeps (1991) defined case in CBI as a "problem-oriented description of a believable event which provides enough details to allow for an analysis of the problem/solution process" (p. 44). Barnes, Christensen, and Hansen (1994) later extended the definition of case and argued that a teaching case can be "a description of episodes of practice, a selection of reality, a slice of life, a story designed and presented as study material, an exercise, a puzzle, or a problem" (p. 71). According to this definition, cases may vary in the type and amount of information they include (e.g., fictional stories, authentic materials) and be presented in different media (e.g., text, video, game) and genres (ethnography, official reports, records).

While cases might take different forms, Riesbeck and Schank (1989) identified two critical aspects for most cases: knowledge elements and a specific context.

Knowledge elements are organized and presented in a specific context to explain how they are applied in the case event, and what strategies or actions are likely to succeed in that specific context. The controversy in a case can promote open-ended discussions in which learners clarify and defend their positions. The ambiguity in a case reflects a more accurate depiction of reality by including contradictions and discrepancies that are resistant to analysis, and usually makes the case fun to analyze and discuss (Barnes et al., 1994).

Cases are often used to draw out the meaning of theories and principles in a specific context and promote reflective activities such as interpretation, problem solving, discussion, and reflection (Doyle, 1990; Sykes & Bird, 1992). As a result, a good case should include adequate contextualized information and critical decision points for learners to analyze a specific situation and evaluate their proposed actions.

Key Characteristics of the Case-Based Method

Sykes and Bird (1992) summarized the relationship between case purpose, case development, and instructional context. They asserted that "case development depends on the context of use and on the part cases will play in the knowledge of the field" (p. 479). As a result, it is important to understand the pedagogical purposes of CBI because they provide a framework to understand, analyze and evaluate the activities prescribed by the case-based method for a specific context. Shulman (1992) surveyed the CBI literature across different disciplines and identified five major purposes of teaching with cases. He provided the rationale for his classification of case purposes and justified the rationale with concrete examples of how cases were employed in real teaching practice. In addition, Shulman (1992) also argued that cases can be used to (a) create or increase

motivation for learning, (b) provide unique benefits for those who participate in case writing, (c) avoid the danger of overgeneralization, and (d) allow learners to form communities for discussion or discourse.

As a result of CBI's application and practice in a wide range of disciplines and contexts, there are different ways of using cases for instructional purposes. Nevertheless, three types of activities are common to almost all applications of CBI, and may be considered key components of the method:

1. Development and presentation of content that is relevant, exemplary, problematic, or controversial (Christensen & Hansen, 1987; Merseth, 1996; Stolovitch & Keeps, 1991).
2. Opportunities for reflection that elicit solutions, analysis, or assessment from learners (Kleinfeld, 1992; Jonassen & Hernandez-Serrano, 2002; Tippens et al., 2002).
3. Facilitation of small-group or large group discussions among learners regarding the cases.

History of the Case-Based Method

Education has a long history of using cases to facilitate teaching (Doyle, 1990; Merseth, 1991; Sykes & Bird,1992). The pedagogy of teaching with cases is believed to have been introduced by Christopher Columbus Langdel, the dean of Harvard Law School in the 1870s, who used selected cases from appellate court records to facilitate discussion and analysis among students (Carter & Unklesbay, 1989). Due to its effectiveness in legal education, the case study pedagogy was later employed in most

well-known law schools in the United States by 1915 (Culbertson et al., 1959), and soon spread to other fields such as medicine and business education (Merseth, 1991).

According to Andrews (2002), the case-based method prepares learners for their future professions by exposing them to the kinds of scenarios and problems they will encounter in their field. Cases have been used with a variety of intended purposes in different fields. For example, in the field of law, a legal case and its verdict becomes an official precedent that requires attention for all lawyers and jurists when facing similar situations (Shulman, 1992). In teacher education, cases such as classroom teaching videos are often used to exemplify how a principle or technique is implemented in a class so that student teachers can follow those examples in their future practice (Sykes & Bird, 1992). In business education, cases largely focus on prompting deep discussion and reflection among learners with the purpose to develop their critical and analytical reasoning skills (Christensen & Hansen, 1987). The pedagogical purposes of CBI in a professional field were often determined by the nature of knowledge existing in that field, and would also define how cases were to be designed, presented, and used in its context of instruction (Merseth, 1991; Merseth & Lacey, 1993).

Theoretical Background of the Case-Based Method

Instead of having only one model or theory, there are multiple learning theories that support CBI and there are multiple models of CBI developed in different fields and disciplines. As a result, ‘case-based method’ or ‘case-based instruction’ in this study are used as umbrella terms for all forms of instruction that include at least the first two of the three key activities listed above and repeated here:

1. Development and presentation of content that is relevant, exemplary, problematic, or controversial (Christensen & Hansen, 1987; Merseth, 1996; Stolovitch & Keeps, 1991).
2. Opportunities for reflection that elicit solutions, analysis, or assessment from learners (Kleinfeld, 1992; Jonassen & Hernandez-Serrano, 2002; Tippens et al., 2002).
3. Facilitation of small-group or large group discussions among learners regarding the cases.

The case-based method is based on the belief that the human mind operates like a pattern recognizer. That is, the human mind has the capacity to identify, associate and organize similar structures, events, or contexts into a meaningful whole (Andrews et al., 2009). This enables learners to generalize from previous experiences and make informed decisions in future contexts. Based on the concept of the mind as a pattern recognizer, the constructivist paradigm and the situated learning theory (Brown et al., 1989; Lave & Wenger, 1991) are considered as the theoretical foundation for the case-based method in this study.

Constructivism

According to Driscoll (2005), CBI is in the constructivist paradigm of learning. The constructivist paradigm views knowledge as "individually and socially constructed through the learner's interpretation of learning experiences" (Jonassen, 1999, p. 217). Similarly, Driscoll described the constructivist view of learners building their knowledge systems by working to resolve their experience in a way that is both active and

meaningful. Jonassen (2003) further noted that knowledge should be built through instruction based on authentic experiences.

Situated Learning

Situated learning, also known as situated cognition, is "the notion of learning knowledge and skills in contexts that reflect the way the knowledge will be useful in real life" (Collins, 1988, p.2). An assumption of situated learning is that meaningful learning often occurs unintentionally in authentic contexts with guided social interaction and collaboration (Lave & Wenger, 1991). By setting learning activities such as problem solving in situations that are authentic and relevant to learners, the situated learning theory also increases the "personal relevance and utility" of those learning activities thus benefits learning from the motivational perspective (Paris, 1997, p.22).

One major goal and a unique benefit of the case-based method is to provide learners with opportunities to practice reflective actions such as analysis, interpretation, decision making, and problem solving (Doyle, 1990; Merseth, 1996; Shulman, 1992; Sykes & Bird, 1992). The analysis and interpretation of cases provide the basis for the decision making and problem solving in CBI, as learners' ability to discern, analyze, and interpret key elements of a scenario allows them to collect adequate data to inform and evaluate their proposed actions (Wasserman, 1994). Some researchers have claimed that a major advantage of CBI lies in its ability to promote critical analysis, decision making, and problem solving (Barnes et al., 1994; Jonassen & Hernandez-Serrano, 2002; Merseth, 1996; Wasserman, 1994). However, only a few studies have been identified in the literature that provide empirical evidence for such claims.

CBI is composed of multiple dimensions. For one, case studies can motivate learners to solve interesting problems that they can connect to authentic situations, Additionally, learners using CBI must focus time and effort on understanding the task. This relates to knowledge transfer. Despite its increasing popularity in various disciplines, there is no universally accepted term for the pedagogy of teaching with cases. The common terms that refer to such pedagogy include case method (Doyle, 1990; Merseth, 1991, 1996), case study (Stolovitch & Keeps, 1991), case-based reasoning (Jonassen & Hernandez-Serrano, 2002) and case-based instruction (Andrews, 2002; Williams, 1992). The meanings of those terms might differ slightly depending on contexts. For example, case-based reasoning is often considered as a learning theory that emphasizes the internal cognitive process of learning from cases, while case-based approach usually refers to a prescribed instructional practice that relies on cases to solve a specific problem.

According to Bonney (2015), the case study teaching method is highly adaptable. It involves problem-based learning and promotes the development of analytical skills. It also facilitates the development of higher levels of Bloom's taxonomy, including analysis, evaluation, and application. Case study teaching, used in business and medical education for many years, has expanded into other disciplines including biology, chemistry, and psychology in recent years.

Ertmer and Stepich (1999) provided an explanation of the CBI process. As they described, CBI guides learners to focus on the fundamentals of the process by structuring complex, ill-defined problems with knowledge placed within the problems. This gives learners the opportunity to find the underlying concepts, and practice their problem-

solving skills in real-world situations. By conducting evaluation and assessment of problems using the CBI approach, learners are more likely to develop skills that enable them to better solve a probe quickly and efficiently.

Case Study Structure

CBI is built on the combination of certain pedagogical elements. According to Hoffer (2020), these elements are material, context, concepts, and method. Material as an element describes a case scenario. It can be in the form of a written document, for example, an essay, newspaper article, or legal case. Alternately, material can be a video or audio presented in place of or in addition to a text document. Materials can incorporate diagrams or other visual elements. Students can be given the option to select a case that personally interests them. Students might be assigned to bring a case or story representing the topic to the group. Material should clearly indicate whether the situation it describes is real-life or hypothetical. The context element is an assigned interaction that is structured by the instructor or the designer to connect the case to the curriculum. Examples of context are asynchronous discussion, questions in an online discussion, or requirements for a deliverable such as a paper or slide presentation that integrates course content into a case response. The next element, concepts, is abstract ideas within a case study. A desired outcome of case studies is that students will connect the abstract concepts in a case scenario to the situation described in a case. The last element, method of interaction (i.e., online or face-to-face, synchronous or asynchronous, assignment or discussion), provides students with variety and engagement (Hoffer, 2020).

In addition to combinations of pedagogical elements, case studies can take different structural forms. Chatman (1980) defined narrative structure, such as that used

in case studies, as "the elements of storytelling, their combination and articulation" (p. 15). Storytelling may include such elements as the introduction, characters, and ending. The combination of elements can be viewed as the story's plot.

Narrative structure can be in linear or non-linear forms. A linear structure is the delivery of material in a sequential order. In contrast, non-linear narrative structures provide minimal structure and allow individuals to explore at will.

The construction of case studies is complex and inherently problematic. Despite this challenge for instructional designers, research suggests that using the case study approach in teaching and learning contexts has the benefits of increasing student engagement, motivation, and focus on the area of study.

Recent Developments in Case Based Instruction

CBI and Web Technologies

The development of technologies such as web-authoring software, e-learning development tools, learning management systems, communication tools, and the Internet have provided opportunities for the development and presentation of cases. As a result, technology-supported CBI has become the prevailing form of case-based instruction since the mid-1990s.

CBI is further supported by the advancement of web-based technologies. These technologies enable multimedia and a variety of interactive functions to be built into web content more easily, and have provided opportunities for developing authentic and interactive cases for instruction. Interactive functions such as prompt questions, automated feedback, and navigation control allow learners to customize their CBI learning process and actively reflect on the case scenario (Luo & Koszalka, 2011). Rich

media such as videos or images often convey more detailed information than text, adding a sense of authenticity to the cases. As a result, interactive multimedia cases are considered as "far more complex and richer than paper-based or simple video-based cases" (Koury et al., 2009, p.299).

Technology-supported CBIs with interactive multimedia elements have become popular and have led to a growing body of research since the mid-1990s (Choi et al., 2008; Jarz et al., 1997; Linn et al. (1996). Benefits of technology-supported CBI identified from this research include engagement in generative discussions (Baker & Wedman, 2002), increased motivation (Hughes et al., 2000), higher-level thinking (Risko et al., 1992), enhanced knowledge transfer (Baker, 2009),and real-world problem-solving ability (Choi & Lee, 2009).

Educational technologies such as video, hypermedia, computer software and the Internet have been widely used in case presentation, facilitating many of the aforementioned practices. For example, Choi et al. (2008) described a case-based e-learning module for anesthesiology instruction. The module included a video clip of a real surgery with a total of 10 critical decision points. It also included expert commentary clips as feedback, and guided students to finish the case report with pre-specified questions. The module explained the purpose of instruction at the beginning, provided resources to activate prior knowledge in the form of hyperlinked text content, and used a variety of scaffolding to emphasize the key points of instruction, and engage learners to reflect on the case problem and its solutions throughout the learning process.

Case-Based E-Learning Modules

E-learning modules in this study refer to instructional units or lessons in electronic format that are self-directed in nature and can be implemented without the facilitation of an instructor. A case-based e-learning module is different from a hypermedia case, as it is more structured and usually provides one or several suggested learning sequences to go through the instructional content. Although case-based e-learning modules might include some online components (e.g., hyperlinked instructional content, web-based interface) or might be accessed online, most can be considered as self-contained instructional packages that can be used in the offline environment if downloaded.

Choi and his colleagues have conducted a series of design-based research that investigated the ways of designing effective case-based e-learning to promote college students' real-world problem-solving abilities across different disciplines, including medicine (anesthesiology) (Choi et al., 2008), teacher education (classroom management) (Choi & Lee, 2009), and engineering (environmental engineering and sustainability) (Choi et al., 2012).

Research Methods Instruction

Earley (2014) noted that since the mid-1970s, research methods instructors have recognized that the ability to conduct research depends on both knowledge and decision-making competence. Earley (2014) conducted a research synthesis of literature about research methods education and found that students in research methods classes frequently have high levels of anxiety about the course, and also have a low opinion about the relevance of the course content and material to their majors, future

employment, and lives. Therefore, research methods instruction needs to address how to increase student satisfaction with the courses, in addition to teaching the content knowledge.

Statement of the Problem

There is a growing body of research that investigated the effectiveness of technology-supported CBI. However, nearly all of the published studies have been conducted in face-to-face classroom settings, and the CBI cases relied on instructor-facilitated instruction rather than instruction contained within the technology itself. There seems to have been little research investigating the application of the CBI method in the context of self-directed online instruction. Not surprisingly, no theoretical framework seems to have been proposed for the key assumptions of both the CBI method and online instruction. There is little empirical evidence regarding the strengths and limitations of applying the CBI method in a self-directed online module. Overall, the CBI method seems to be rarely practiced by instructional designers when creating online instructional materials. A promising use of online CBI is delivery of feedback. This type of delivery offers the opportunity to provide immediate, standardized, item-specific responses to the assessment answers that learners submit. Research is needed to investigate the effectiveness of online CBI feedback.

Research Questions

Two research questions were investigated in this study:

Research Question 1. Is there a difference in student test performance when using an online case-based study approach with feedback, as compared to an online case-based study approach without feedback in a research methods course?

Research Question 2. Is there a difference in student satisfaction when using an online case-based study approach with feedback, as compared to an online case-based study approach without feedback in a research methods course?

Definition of Key Terms

Case - Case is a description of a believable fictional or actual event which is problem-oriented and detailed enough to allow for the problem and solution process to be analyzed (Stolovitch & Keeps, 1991).

Case-based instruction - Case-based instruction (alternately known as case-based learning, case-based method, or case study method) is teaching by using authentic case studies to solve real-world problems in a course or training environment. It is a problem-based approach in which learners are required to actively participate in working through authentic situations to answer questions and construct solutions (Wilson et al., 2002; Hmelo-Silver, 2004; Ertmer & Russell, 1995).

Constructivism - Constructivism is the view that learners individually and socially construct their knowledge through their interpretation of learning experiences (Jonassen, 1999).

Metacognition - Metacognition is a form of executive control involving observing, monitoring, and regulating one's own cognitive processes in learning; 'thinking about thinking.'

Problem-based learning - Problem-based learning is an instructional approach which uses complex real-world problems to promote active student learning of concepts and principles.

Research Methods Anxiety - The "complex array of emotional reactions which occur when a student encounters research methods in any form and at any level" (Papanastasiou & Zembylas, 2008, p. 156).

Situated learning - Situated learning is the learning of knowledge and skills in authentic contexts that reflect how the knowledge will be used in real life.

Purpose of the Study

The purpose of the study was to investigate how and with what effects case studies can be used in an individual online module within a face-to-face research methods course. The study examined whether a case study with feedback was more effective in improving test performance and satisfaction with learning, compared to a case study without feedback. This may provide evidence about whether online CBI feedback is feasible to implement for research methods courses in order to improve student learning and satisfaction.

Chapter Summary

In Chapter I, I provide a brief background and description of case-based learning and online case studies. The use of case studies in instruction and the key characteristics of the case-based method are described. The history, theoretical background, and structure of case studies are outlined. Recent developments in case-based instruction, including online technologies and e-learning modules were reviewed. The chapter concludes with a statement of the problem, research questions, key term definitions, and purpose of the study. In Chapter II, I review the literature relevant to this research study.

CHAPTER II

REVIEW OF THE LITERATURE

In Chapter II, I provide a review of the literature on the topics that concern CBI in an online environment. Specifically, the advantages and disadvantages of using CBI are addressed. Further, the use of CBI in an online context is presented, as well as using the case study method individually, the advantages, disadvantages, and challenges of using case studies, as well as student performance and satisfaction in online CBI. Finally, a theoretical framework of CBI and the research hypotheses of this study are provided.

Case-Based Instruction in General

Many researchers have considered the case-based method an effective pedagogical approach to develop learners' problems solving skills (Choi & Lee, 2009; Jonassen, 2010; Merseth, 1996; Schank, 1999). This is because the case event can provide a context for framing the problem (Williams, 1992), and case-based reasoning can help learners recognize, analyze, and refine solutions through experience-based knowledge construction (Jonassen & Hernandez-Serrano, 2002).

The active learning inherent in case studies prompts learners to connect theory to practice. Case analysis presents an experiential opportunity for learners to solve problems realistically. Thus, case studies enable experimentation and reflection without impacting actual organizations or participants. Students experience a realistic sense of the

researcher's role and the nature of research, as well as an understanding that alternative approaches and answers are possible (Salmons, 2014).

Choi and Lee (2009) proposed a case-based instructional model (CBL-CMPS) for teaching classroom management, and investigated its effectiveness on the development and transfer of problem-solving skills. The results showed that the treatment group (CBI) increased all seven sub-skills of problem solving (e.g., multiple perspectives, justification, critical thinking, linking to theory) significantly in each stage of the CBL-CMPS model ($p < .05$), with a significant difference between the treatment group (CBI) and the control group (non-CBI) in the transfer measurement of those skills [$F(7, 38) = 4.95$, $p < .001$]. The research finding suggests that the CBL-CMPS model was effective for developing problem solving skills and facilitating the transfer of learning in solving other problems.

Effects of the Case-Based Method on Affective Learning

Affective learning refers to the emotional and attitudinal aspects of learning, including attention, interest, motivation, engagement, concern, and values (Krathwohl et al., 1956). There appear to have been only a few empirical studies that were designed to investigate CBI's influence on students' affective learning. However, the literature revealed several tangential positive results in affect, including increased motivation, emotional involvement, and self-confidence.

Motivation

Some researchers consider CBI to be more motivating than traditional lecture-based instruction, and have argued that cases were shown to be effective in stimulating learners' interest to study the material presented (Barnes et al., 1994; Shulman, 1992;

Wasserman, 1994; Williams, 1992). For example, Van den Berg et al. (2004) examined the effectiveness of a multimedia case in facilitating a workshop that taught student-teachers how to incorporate science education into project-based activities in elementary schools. Questionnaires indicated that 87% of student-teachers saw the multimedia case as a useful and motivating learning tool. Observation data revealed that the student-teachers showed greater interest in studying the case. The researchers noted that some student-teachers elected to cancel other obligations to continue working with the case until the session ended.

Although many researchers did not investigate the construct of motivation in particular, the data often suggested that student-teachers demonstrated greater interest for studying cases and preferred CBI over lecture-based instruction. Herreid (1994), for example, compared attendance in a traditional science education course with a case-based redesign of the course. Students were more likely to attend classes in the case-based course (95%) compared to the traditional course (50-65%).

In a study of the use of cases in preparing senior-level music teachers, Bailey (2000) found that cases were associated with pre-service teachers feeling increased need and relevance to engage in the music instruction. Bailey argued that the effectiveness of cases in this study was related to the students' perceived needs and applicability to the situations they faced.

A potential limitation of these studies is that the constructs of motivation and interest were examined through the researchers' observation or measurements such as attendance or time on task.

Emotional Involvement

One widely acclaimed benefit of CBI is its ability to emotionally involve learners during the instruction. Andrews et al. (2009) argued that this "emotional engagement or entertainment" (p. 9) is an important purpose of narrative cases that differentiates CBI from other types of instruction. Shulman (1992) expressed similar views and asserted that CBI was "more engaging, more demanding, more intellectually exciting and stimulating" (p.1).

Kang and Lundeberg (2010) investigated how a case-based online learning environment could increase female students' participation in science teaching. The CBI in the study involved students watching video cases of HIV patients, gathering relevant information online, running simulated tests on case patients, and creating diagnosis reports. The study was focused on the learning experiences of two female students, and found that presenting realistic cases of HIV patients facilitated the students' emotional connection with the subject matter and greater engagement in the learning activities. One student reflected that "pictures and words showed emotion more. It made you more attached to the case and made you look in a textbook and read more. It's like you are seeing someone going through this" (p.1132).

Research findings also suggest that the use of cases can actively involve teachers in various learning activities such as analysis, discussion, and reflection. One such study (Angeli, 2004) found that pre-service teachers were more willing to participate in case analysis and discussion because cases depicted the complexity of authentic teaching practice, which pre-service teachers considered both challenging and fun. In another study, Baker (2009) also recognized the effectiveness of CBI in engaging learners in

active learning, noting that the pre-service teachers in a case-based literacy course asked more questions and higher-level questions, as well as taking multiple perspectives.

Effects of the Case-Based Method on Metacognitive Learning

Metacognition, or "thinking about thinking" in laymen's language (Flavell, 1979) s defined as a form of executive control that involves observing, monitoring, and regulating one's cognitive process in learning activities (Kuhn & Dean, 2004; Martinez, 2006; Schneider & Lockl, 2002). The domain of metacognitive learning was not well-defined in the literature and typically overlapped with cognitive and affective learning domains. The following studies focus on reflective thinking, an activity that is widely accepted as a key component of metacognitive learning (Hofer, 2004).

Stimulating learners' reflective thinking is considered as an important purpose and a major benefit of CBI (Jonassen & Hernandez-Serrano, 2002; Shulman, 1992). Kleinfeld (1992) asserted that the use of cases could help learners develop "the habit of reflective inquiry" (p.47). Shulman (1992) also considered the case-based method appropriate for teacher education because the complex nature of cases encourages elicit reflective practices. Empirical evidence that supports the efficacy of CBI in promoting reflective thinking was found in the literature. In one such study, Rosen (2009) investigated the impact of CBI on student-teachers' reflection on facilitating children's learning. Sixty-eight participants were assigned to three groups: two treatment groups receiving CBI in written or video format, and a control group receiving non-CBI. The Reflective Thinking Scale (RTS) was used to measure student-teachers' reflective thinking was measured by the before and after the instruction. The two treatment groups scored much higher on the posttest RTS (5.14 and 4.15) compared to the pretest scores

(2.95 and 3.10), and the control group showed little difference between the pretest and posttest RTS scores (3.37 and 3.53). Based on these findings, Rosen (2009) concluded that CBI in teacher education can improve reflection on educational theories and in instructional practices.

In a study by Hewitt et al. (2003) practically almost all pre-service teachers in a CBI course indicated they believed case discussion and analysis to be of value to them professionally, and made them more aware of their reactions to teaching situations. One participant reflected that the case discussion allowed her to think about her decisions and immediately collaborate with colleagues. Another participant commented that the activity enabled her and her colleagues to evaluate how they think about teaching, and see differences and commonalities in their perceptions.

In addition to case analysis and discussion, case writing activity was also found to initiate and support reflective thinking for student-teachers. For example, Richert (1991) examined how student-teachers constructed self-reported cases in a teacher education class. The activity of preparing cases was found to be a reflective practice that engaged student-teachers in making and evaluating the key decisions of case construction, as well as reflecting on their own teaching experiences.

In another study of reflection in CBI, Hewitt, Pedretti, Bencze, Vaillancourt, and Yoon (2003) described the decision-making practice in a case-based teacher education classroom which used a series of video cases to portray a third-grade science lesson. The instructor in the video cases was a first-year teacher and encountered many unexpected situations that required immediate reactions. The video cases stopped at each decision point to allow pre-service teachers to quickly suggest decisions for the instructor to deal

with the situation. Pre-service teachers then wrote down their proposed decisions and later shared, analyzed, and revised them during the case discussion. The results of reflection analysis and participant questionnaires indicated that the CBI encouraged teachers to take the perspective of moment-by-moment decisions for teaching, and actively engaged teachers to examine their decision-making process through reflection and discussion.

Hourigan (2008) also found that student-written cases were perceived as beneficial by student-teachers enrolled in an instrumental music methods class. The participants noted that case writing provided them with opportunities to "reflect on their past," "express their opinions and beliefs about music teaching and learning," and "construct their own identity as music teachers" (Hourigan, 2008, p.30). As one student revealed in the interview, "This (case writing) forced me to dedicate some time for reflection that I would have not done otherwise" (Hourigan, 2008, p.30).

Feedback in CBI

Race (2006) defined feedback as information communicated to a learner resulting from a learning-oriented action. Race (2006) further noted that electronic feedback enhanced the production, delivery, and communication of feedback. An advantage of online feedback is its proximity in time to the performance. In an online learning environment, technology makes it possible to integrate feedback so that it can be used in several ways. For instance, online feedback can be used to evaluate student performance, develop students' knowledge and performance, develop students' knowledge and understanding, and increase their motivation to engage with the instruction (Hyland, 2000).

Despite research which supports the effectiveness of feedback, there is also evidence that students frequently do not collect the feedback available to them. Reasons include a lack of motivation, the quality and quantity of the feedback, and the communication method of feedback delivery. The effectiveness of feedback may be improved by communicating it through the student's online learning space, such as a module within a Learning Management System (LMS). LMSs can provide feedback through online assessments consisting of objective-answer questions. This type of assessment enables feedback which students can see immediately. Hatziapostolou and Paraskakis (2010) developed a Web-based feedback system and found that it was effective in promoting learning by providing high-quality feedback and ensuring that students engaged with the feedback.

Van der Kleij et al. (2015) noted that assessment plays a critical role in the learning process. Although many researchers accept that formative assessment has a positive effect on students' learning outcomes, Van der Kleij et al. (2015) acknowledged that Bennett (2011) questioned these claims and stated that most are based on sources that are flawed, outdated, or unpublished.

Van der Kleij et al. (2015) conducted a meta-analysis to determine the extent to which the method of feedback in computer-based learning affected students' learning outcomes. 40 relevant studies were identified by Van der Kleij et al. (2015). In this meta-analysis, students received item-specific feedback for every item in a formative assessment, either immediately or following a delay. The results of the meta-analysis showed that elaborated feedback (i.e., with an explanation) resulted in larger effect sizes (0.49) than feedback about the correctness of an answer (0.05) stating the correct answer

(0.32). Elaborated feedback was markedly more effective for higher order learning outcomes. Delayed feedback negatively affected effect sizes.

Advantages of CBI

According to Mundy and Consoli (2013), achieving learner engagement with instructional content is a challenge in teaching. Earlier, Schulman (1992) had suggested that the case-based method may solve this issue, as it is considered to be "more engaging, more demanding, more intellectually exciting and stimulating, more likely to bridge the vast chasm between principle and practice" (Shulman, 1992, p.1). Other studies also found support for CBI's positive effect on learner engagement. For example, Marcus, Taylor, and Ellis (2004) investigated CBL in veterinary science education. The researchers found that realistic aspects of case studies engaged students, leading to increased understanding instead of simply knowledge acquisition.

Thistlewaite et al. (2012) found that professional healthcare students and teachers positively reacted to improved learning outcomes, and increased engagement and motivation in a CBL course.

Nicklen et al. (2016) compared outcomes in face-to-face and online case-based learning in an undergraduate physiotherapy course. They found similar and positive outcomes for both CBL delivery approaches, although some participants were dissatisfied with the case delivery technology. Positive outcomes included improved understanding and application knowledge, as well as positive engagement.

In a study by Mayo (2002), participants reported that CBI increased their interest in and ownership of the subject matter. Case study participants were found to have

significant increases in self-reported control of learning, task value, and self-efficacy for learning and performance.

Kleinfeld (1991) found strong support for the case-based method. In this study, 54 student-teachers enrolled in an introductory foundations course were randomly assigned to weekly section meetings taught by either the case-based method (treatment group) or the general discussion of readings (control group). The treatment group taught by the case-based method demonstrated significantly greater ability to identify and analyze educational problems than the control group. Student-teachers' responses to a problematic situation were measured in the mid-term exam as the learning outcomes. Analysis of the exam data showed that the case-based method increased student-teachers' skill in identifying issues in problematic situations, analyzing educational dilemmas, and identifying possible alternatives for action.

More recently, Floyd and Bodur (2005) conducted an empirical study to examine the effect of CBI on pre-service teachers' decision-making skills. Results showed that accompanying field experiences with case studies and case writing helped pre-service teachers make informed decisions on various educational issues including diversity, inclusive classrooms, religion sensitivity, and English for speakers of other languages (ESOL). Floyd and Bodur (2005) argued that such findings were consistent with the results from an earlier study conducted by Doebler, Roberson, and Ponder (1998), which showed that when teachers analyze critical decisions in cases they may develop a "progressive sophistication of response" (p.358) to deal with complex teaching problems and come up with reasonable, informed solutions.

Disadvantages of the Case-Based Method

The current literature review has identified various positive effects of the case-based method on learners' cognitive, affective, and metacognitive learning. There are disadvantages as well. Shulman (1992) identified the following potential disadvantages of the case-based method that were well-cited in the literature:

- Cases are expensive and time-consuming to produce.
- Cases are difficult to teach well and require longer time for preparation.
- Cases can be inefficient for teaching certain content, with long periods of time in which very little material is covered.
- The episodic and discontinuous nature of cases can be difficult for some students to structure, organize, and integrate.
- CBI is susceptible to over-generalization with too much emphasis on the specifics of one single case.

Despite the potential disadvantages, CBI that is well-designed and implemented has many potential benefits for teaching and learning. However, not all instructors are skilled in writing cases and facilitating case-based discussion (Barnes et al., 1994, p.48). As a result, a few studies found no significant difference in students' learning outcomes when comparing CBI and traditional lecture-based instruction (Kirschner et al., 2006; Uribe & Klein, 2003). A few researchers noted that ineffectiveness of CBI might be caused by cognitive overload, since poorly designed cases or poorly facilitated discussion often include too much irrelevant information that overwhelms learners' cognitive capacity and interferes with the learning process (Paas et al., 2003; Van Merriënboer et al., 2006).

One of the most commonly discussed disadvantages of the case-based method is its ineffectiveness for certain groups of students. Cossom (1991) argued that "clearly (case-based instruction) is not a teaching/learning method that appeals to all students, nor is it one that draws neutral responses" (Cossom, 1991, p. 151), because the inherent features of CBI such as "ambiguity, lack of 'right' response, and multiplicity of views" (Cossom, 1991, p.150) were perceived and appreciated differently by learners with varying levels of moral and cognitive development.

Ertmer et al. (1996) expressed a similar view in their investigation of a case-based physiology course. They found that not all students enjoyed and benefited from cases. Student approaches to CBI can be limited or facilitated by differences in certain learner characteristics such as goal orientation, evaluative lenses, levels of self-awareness, openness to challenges, perceived levels of relevant knowledge, and contextual vulnerability. Students with low self-regulation more often focused on learning facts and being correct when studying the cases. There were fluctuations in their perceptions of the usefulness of the case method, and in their confidence for learning from cases" (Ertmer et al., 1996, pp.745-746).

Choi et al. (2008) further explored the relationship between the learning experience in CBI and learners' characteristics and found that concrete thinkers, practice-oriented learners, and those who prefer to learn in small incremental steps tended to have more meaningful experience with CBI. In contrast to the common belief, visual learners and verbal learners reported no significant difference in their learning experience with the CBI lesson.

Many of the potential problems of CBI may be resolved or avoided with the support of educational technologies. For example, e-learning development tools can provide case developers with various templates and resources. Multimedia technologies can present a case in multiple media forms to accommodate different learning preferences. Additionally, the use of animated cues and interactive elements can provide needed scaffolding to learners.

Online Instruction Exercises with CBI

As stated in Chapter I, technology-supported CBIs that integrate interactive multimedia elements began to be more frequently used in the mid-1990s. Benefits of technology-supported CBI identified from research include engagement in generative discussions (Baker & Wedman, 2002), increased motivation (Hughes et al., 2000), enhanced knowledge transfer (Baker, 2009), and real-world problem-solving ability (Choi & Lee, 2009). Although research has investigated the effectiveness of technology-supported CBI, most studies were conducted in conventional classroom settings and nearly all of the CBI cases relied on instructor-facilitated instruction rather than instruction embedded within the technology. I found few studies investigated the application of the case-based method in the context of self-directed online instruction. Only three self-directed CBI interventions, including a case-based e-learning module for environmental engineering design (Choi et al., 2012), an online case-based learning environment for teaching classroom management (Choi & Lee, 2009), and a multimedia-CBI lesson for anesthesiology instruction (Choi et al., 2008) were found during the review of the literature from 1990 to 2012. Consequently, a theoretical framework that embraces the key assumptions of both the case-based method and online instruction

seems to be absent from the literature, and there is little empirical evidence regarding the strengths and limitations of applying the case-based method in the self-directed online setting.

Choi et al. (2008) examined the effects of a multimedia CBI lesson for teaching anesthesiology in which an anesthesiologist had to make 10 critical decisions in an operation. Students in the CBI lesson were guided by the commentary of an expert at each decision point in order to solve the given problem. The research finding reported generally positive findings regarding the CBI lesson, including higher level of motivation, increased anesthesiology knowledge, and improved problem-solving skills. One important finding of the study was that different learning styles affected the perceived effectiveness of CBI, as students of sequential, sensing, and reflective learning styles reported to have a more meaningful learning experience.

Hayward and Cairns (2001) examined the case-based learning experiences in an advanced cardiopulmonary science course that had students study clinical cases over the internet. Students' perceptions of and experiences with the online CBI were collected by an online survey and follow-up interviews. The results indicated that the online case learning experience assisted students to connect theoretical knowledge with practical application. Students also expressed a preference for online CBI and believed that the online case assignments were better than traditional lectures for teaching advanced cardiopulmonary sciences. Hayward and Cairns (2001) also found that while the internet could increase students' access to information, it was challenging and distracting for some students. Students also considered working with others in online groups as quite stressful and indicated a preference to work individually when studying cases online.

Guest (2007) conducted a similar study investigating the student performance and satisfaction of three groups of students who received individual online CBI, small-group online CBI, and lecture-based instruction in an educational psychology course. It was found that student satisfaction about the course differed significantly among the three groups, with the online individual CBI group reporting the highest satisfaction. One interesting finding was that when studying cases online students preferred individual work to group work, which supported the finding from Hayward and Cairns' study (2001). Guest (2007) compared the student performance among the three groups but found no statistically significant difference. She believed several limitations of the research design might have caused such no difference, including short instruction time, high attrition rate, unbalanced incentives, and potential experimenter bias.

Use of Case Studies/CBI in Research Methods Instruction

Salmons (2014) provided an outline of one approach to using cases to teach research methods. Preparing an annotated bibliography, for example, is a form of CBI. It enables learners to acquire practical skills by analyzing papers for the problem, purpose, research design, findings, strengths, and weaknesses (Salmons, 2014). For the purpose of teaching research methods, Salmons defined a research methods case, or case study, as a narrative account from the researcher's perspective of how an actual study is conducted.

Grant and Grace (2019) investigated the use of case studies to improve student engagement with an undergraduate research methods and statistics course. Feedback from previous classes as well as the literature indicated high levels of student anxiety in research methods courses. Grant and Grace (2019) devised case studies to use as a teaching tool without requiring major changes in the course's assessment or delivery

structure. Feedback data suggested that the case studies moderately increased student engagement and satisfaction with the course. Student feedback suggested improved learning, but a comparison to previous classes found no significant difference in grades.

Issues in Research Methods Instruction

Research methods instruction is associated with factors in addition to learning and satisfaction, including student attitudes and anxiety. Elements that may lessen the negative impact of these factors can be integrated into CBI.

Student Attitudes

Earley (2014) found evidence through a review of the literature that student attitudes and perceptions toward research methods courses can impede their learning and achievement in such courses. For example, typical findings from the articles in Earley's (2014) literature review revealed that students do not see how the course is relevant to their majors or their lives.

- Are often anxious or nervous about the course content and its difficulty;
- Are uninterested and unmotivated to learn the material;
- Have a negative attitude toward research;
- Come to the course with misconceptions about research.

Sizemore and Lewandowski (2009) investigated whether an increase in knowledge of research and statistics would be accompanied by more positive attitudes toward research. The researchers surveyed students at the beginning and end of a research and statistics undergraduate course and found a significant increase in knowledge. In terms of attitude, however, four of six measures did not change. The two attitude measures (perceived

utility of research and statistics) that did change showed a significant decrease over the course term.

Harlow, Burkholder, and Morrow (2002) found gains in both knowledge and positive attitudinal changes when strategies to improve student attitudes about research were incorporated into a course. Self-efficacy increased, and anxiety decreased. Instructor strategies for attitude change included opportunities for individual attention, clarifying course material, and providing performance feedback to each student.

Student Anxiety

Student anxiety about research methods courses is of particular concern. Anxiety over research methods courses can influence a student's ability to understand and apply new concepts. Anxiety can also limit a student's ability to read critically or appreciate the value of research (Papanastasiou & Zembylas, 2008).

Statistics course anxiety among students has been extensively studied, but research methods anxiety has received less attention. Research methods anxiety has been defined as "the complex array of emotional reactions which occur when a student encounters research methods in any form and at any level" (Papanastasiou & Zembylas, 2008, p. 156).

Research in statistics anxiety has revealed some strategies that have been successfully used to reduce anxiety. These include providing extensive feedback, using real world examples for applying learning, and addressing methods to relieve anxiety (Onwuegbuzie & Wilson, 2003).

Research Questions and Hypotheses

The following hypotheses to be investigated in this study are based on the information gained from the literature review. Immediate and item-specific feedback in online CBI informs learners whether their answers were correct or not. The purpose of feedback in this scenario, however, goes beyond giving learners the correct answer. It supports them in accomplishing higher-order learning activities, such as comparison, evaluation, critical analysis, and reflection (Van der Kleij et al., 2015). The literature reports that the immediate, elaborative, and text-based feedback in online CBI has been found to result in more effective learning and increased motivation (Van der Kleij et al., 2015). This study extends and refines the existing body of research.

Research Question 1

Research Question 1. Is there a difference in student test performance when using an online case-based study approach with feedback, as compared to an online case-based study approach without feedback in a research methods course?

Research Hypothesis 1. Students who use case-based instruction with feedback will have higher test performance than students who receive the case-based instruction without feedback.

Research Question 2

Research Question 2. Is there a difference in student satisfaction when using an online case-based study approach with feedback, as compared to an online case-based study approach without feedback in a research methods course?

Research Hypothesis 2. Students who use case-based instruction with feedback will have greater satisfaction with learning research method topics than students who receive case-based instruction without feedback.

Chapter Summary

In Chapter II, I provide a review of the case-based method, a well-established and well-researched instructional-design theory which has been widely used in many disciplines in the past. However, there is no clear and widely accepted definition for what qualifies as the case-based method, as it can take many forms and consist of different learning activities. Several key characteristics of the case-based method are identified, including its theoretical foundations, pedagogical purposes, and essential activities. The key characteristics and essential activities prescribed by the case-based method are reviewed. The chapter concludes with a discussion of the case-based method and CBI in different instructional contexts. In Chapter III I review the methodology of this research study.

CHAPTER III

METHODOLOGY

This research study focused on the effects of CBI with feedback on student test performance and satisfaction in learning a basic-level research methods course module. This chapter describes the research questions and design, variables, participants, instruments, and procedures that were used to investigate the research hypotheses and questions.

Research Design

The purpose of this study was to examine whether using CBI with feedback would increase test scores and satisfaction with research methods instruction, compared to CBI without feedback. To investigate these questions, I used a randomized experimental quantitative pretest-posttest control-group research design.

Participants

This study used convenience sampling. Three different samples were used. Participants in each sample were recruited from a different course. Initially, participants were students enrolled in PSY 220, Research Design & Analysis I, an undergraduate course in research methods in psychology at a medium-sized public University in the Southeast United States. This is a required core course for psychology majors. The university catalog describes the course as “Research methods in psychology with an

emphasis on the experimental method." Completion of PSY 120, Introduction to Psychology, or PSY 121, Honors General Psychology, is a prerequisite for PSY 220. Classes are held face-to-face, and also include an online component through the Canvas learning management system (LMS). The present study examined the use of CBI in an online lesson in this course.

To increase the number of participants in the study, and to account for a ceiling effect that was observed, I added two other courses to the study. One was a research methods course in interdepartmental education, IDE 510, Educational Research and Evaluation. According to the university catalog, this course examines "research and evaluation methodology, its application to questions in education, and the application of research findings to problems in education. The students will read and evaluate research in education." IDE 510 was conducted fully online. The third was an undergraduate course in educational technology, EDM 310, Microcomputing Systems. It is described as "Basic understanding of current and emerging technologies for instructional purposes." EDM 310 was a blended course with face-to-face classes combined with an online component.

Participants from the PSY 220 and IDE 510 courses were likely to have had some previous exposure to the instructional content of the intervention, research methods, due to their field of study and course prerequisites. In contrast, research methods was not central content for the educational technology course, so participants from EDM 310 were less likely to have been exposure previously to the instructional content of the intervention. There were 46 participants from the psychology course, 37 from the research methods course, and five from the educational technology course. No

demographic data was collected. For the psychology course, 35 participants completed the satisfaction questionnaire. This was due to the questionnaire being administered in a face-to-face class session instead of online. Completion was limited to those participants who attended class in person that day.

Forty-six participants received online case-based instruction without feedback (control group) and 42 participants received case-based online instruction with feedback (treatment group). The total number of participants was 88 (46 for control, without feedback; 42 for treatment, with feedback).

Description of the Intervention

The intervention is titled "A Case Study in Research Methods" (Appendix E, Without Feedback, and Appendix F, With Feedback). This case study presents a conversation between two students, Jesse and Taylor. Their conversation concerns a claim in an article that listening to music improves cognitive skills and attitude. They decide to conduct their own research on the topic. Participants in this study are instructed to think about how they would design a study to investigate the claim about listening to music. Participants are presented with a 6-item multiple choice quiz about designing a research study. Participants in the control group answered the quiz questions but did not receive any feedback.

Participants in the treatment group received immediate feedback to each question via an onscreen message, informing them if their response was correct. For correct responses, a brief sentence was also provided to summarize the reason the answer was correct. Incorrect answer notifications were accompanied by a brief sentence summarizing why the answer was incorrect.

Participants with incorrect answers were instructed to return to the question, and choose another answer. This would be repeated until the participant answered correctly.

Once a participant submitted a correct answer, they were instructed to continue to the next question, until all six had been answered correctly.

Time to complete the intervention was estimated to be five to 15 minutes. The intervention was delivered to participants during the second week of the study. Participants were randomly assigned to either the experimental or control group. The experimental group received an online case study with feedback. They were instructed to read the case study and then answer a series of questions related to the instructional content. After each answer, the participant was informed whether their response was correct or not, and feedback was provided to explain why their answer was correct or not. If incorrect, the participant selected another answer as many times as necessary to get the correct answer, with feedback provided for each answer. Participants in the control group received the same online case study as the experimental group, and answered the questions but without feedback.

The case study was borrowed from the National Center for Case Study Teaching in Science (Hager, 2004), and modified to fit the current study. At the end of the case study, participants were presented with a series of six multiple-choice questions about how they would design a research study based on the scenario depicted in the case study they read. The modified case study has two versions: without feedback (Appendix D) and with feedback (Appendix E). The pretest and posttest (Appendix B) were created to be relevant to the content of the modified case study.

Instruments

Instruments included a 20-item pretest and posttest multiple-choice performance quiz assessing knowledge (Appendix B) created for the study, and an 11-item satisfaction with instruction questionnaire (Appendix C).

Two research methods professors and I created the performance quiz. It was designed to measure basic knowledge of research methods. It addressed three topics: independent and dependent variables, experimental research and nonexperimental research, and necessary conditions for causations.

Participants were also asked to complete a satisfaction with instruction questionnaire. Two research methods professors and I created this questionnaire. It consists of 11 items about participants' opinion of the research study in which they are taking part. Participants chose from answers on a 5-point scale: strongly disagree, disagree, neutral, agree, or strongly agree.

Independent Variables and Dependent Variables

The independent variable in this study was the type of an online case-based module (with feedback vs. without feedback). Participants in the with feedback condition answered questions and received immediate feedback. If their answer was incorrect, they repeated the question and received feedback for each answer until they answered correctly. Participants in the without feedback condition answered questions but did not receive any feedback.

Two dependent variables were measured. One dependent variable was participant knowledge performance as measured by test score on the posttest. An additional

dependent variable was participant satisfaction with the online case-based module as indicated by 5-point scale responses on a questionnaire designed for this study.

Procedure

Students enrolled in the courses were notified of their opportunity to participate in this research study through a course announcement delivered online in the Canvas LMS. Consent forms (Appendix A) were electronically attached to the case study. The consent form provided information about confidentiality, purpose, and procedures of the study. Students clicked a button at the end of the consent form to signify their consent to participate in the study.

Data collection took place during the Fall semester of the 2021-2022 school year. The data was collected through an online component delivered to participants through the Canvas LMS and through Qualtrics, with the exception of the psychology course, for which the satisfaction questionnaire data were collected in person after participants completed the knowledge posttest. In the other two courses, data were collected through Qualtrics immediately following the posttest.

The research was conducted in each course over a two-week period. For each course, participants were notified about the upcoming study through an email in the Canvas course site and given access to the consent form and the pretest in Week 1 of the study. For the psychology course, this was Week 6 of the 16-week fall semester. For the research methods course and the educational technology course, this was Week 11 of the fall semester. The topics of the case study had already been covered in the psychology and research methods courses prior to the study.

In Week 2 of the study, participants were given access to the case study, knowledge posttest, and satisfaction with instruction questionnaire through the Canvas course site. For the psychology course, this was Week 7 of the fall semester. For the research methods course and the educational technology course, this was Week 12 of the fall semester. Those who consented electronically to participate in the study were randomly assigned to either the treatment group or the control group. Participants in both groups were given their case study and direction for completing it through the Canvas course site. When they accessed the case study, the participants were presented with text instructions on how to proceed. They were prompted to open the case study file, read the instructions, and proceed as instruction with the case study. At the end of the case study, participants were presented with a series of six multiple-choice questions about how they would design a research study based on the scenario depicted in the case study they read.

When each participant completed their case study, they immediately received the knowledge posttest and the satisfaction with instruction questionnaire.

Both the experimental group and control group participants received the same case study in the online lesson. All participants also received the same knowledge pretest, posttest, and satisfaction with instruction questionnaire. Participants were randomly assigned to no feedback (control group) or with feedback (treatment group). Participants in both groups received pretest and posttest performance quizzes.

Chapter Summary

In Chapter III I discuss the research design of the study. The chapter includes operationalization of the independent and dependent variables, and descriptions of the participants, instruments, and intervention. Participant consent, the treatment period, and

procedures of the study are also described. In Chapter IV I review the results of this research study.

CHAPTER IV

RESULTS

In Chapter IV I present the research findings. I begin with the research questions and hypotheses, followed by the results for each question. Results for student performance were analyzed first, followed by the results for the satisfaction variable. The purpose of this study was to investigate the effectiveness of case-based instruction on research methods lessons in an online environment. Specifically, the question of interest was, would online case-based instruction with feedback be more effective in increasing test performance and satisfaction with the instruction, compared to online case-based instruction without feedback?

Quantitative Analysis

Data Screening

First, individual cases were examined for missing data. Next, each variable was reviewed for outlier data that may cause undue influence on the results. No missing or outlier data were identified; therefore, no participants were removed.

Tests of the Hypotheses

Research Question 1

Is there a difference in student test performance when using an online case-based study approach with feedback, compared to an online case-based study approach without feedback in research methods instruction?

Research Hypothesis 1. Students who use case-based instruction with feedback will have higher test performance than students who receive the case-based instruction without feedback.

Research Question 2

Is there a difference in student satisfaction with the instruction when using an online case-based study approach with feedback, compared to an online case-based study approach without feedback in research methods instruction?

Research Hypothesis 2. Students who use case-based instruction with feedback will have greater satisfaction with learning research method topics than students who receive case-based instruction without feedback.

Analysis of Covariance (ANCOVA) and Analysis of Variance (ANOVA) were used to test Hypothesis 1 and 2, respectively. For the first research question/hypothesis, I checked for the main effect of the IV, controlling for any pretest differences between the groups. The dependent variable was student posttest knowledge performance. For the second research question/hypothesis, I checked for the main effect of the IV. The dependent variable was satisfaction.

To test the first research question/hypothesis, an ANCOVA was conducted to compare the posttest knowledge performance scores of the experimental group (with

feedback) and the control group (without feedback), after controlling for pretest performance group differences (measured by the covariate). Before running the ANCOVA, I checked to determine if the data met the statistical assumptions of ANCOVA. The homogeneity of slopes assumption was checked by examining the interaction of the groups IV and the covariate (which should not be statistically significant). In this case the assumption was not violated, $p < .001$). The homogeneity of variances assumption of the ANCOVA was met according to Levene's test ($p = .816$). The normality assumption was met according to the Shapiro-Wilk test ($W = 0.975$, $p = .088$).

The hypothesized difference between the group performance means, stated in hypothesis 1, was tested using ANCOVA, and the main effect for group was not statistically significant, $F(1, 84) = 0.319$, $p = .574$. Students who used case-based instruction with feedback did not perform better on a knowledge posttest, compared to students who received case-based instruction without feedback. Therefore, hypothesis 1 was not supported. Table 1 shows the performance means and standard deviations for the two groups.

Table 1

Descriptive Statistics for Performance

Group	Pretest *M*	*SD*	Posttest *M*	*SD*	*N*
Feedback	.680	.225	.693	.236	42
No Feedback	.698	.217	.704	.215	46
Total	.689	.220	.693	.224	88

Note. Table 1 shows the pretest and posttest performance means and standard deviations for the feedback and no feedback groups. No statistically significant difference was found between the two groups, $F(1, 84) = 0.319$, $p = .574$.

To test the second research question/hypothesis, an ANOVA was conducted to compare the posttest satisfaction scores of the feedback and no feedback groups. Before running the ANOVA, I checked to determine if the data met the statistical assumptions of ANOVA. The homogeneity of variances assumption was not met according to the Levene's test ($p < .05$).

The hypothesized difference between the group means, stated in hypothesis 2, was tested using ANOVA. The difference between the groups was not statistically significant, $F(1, 73) = 0.104$, $p = .748$. Students who used case-based instruction with feedback did not have greater satisfaction after completing the case, compared to students who received case-based instruction without feedback. Therefore, hypothesis 2 was not supported.

Table 2 shows the satisfaction means and standard deviations for the two groups.

Table 2

Descriptive Statistics for Satisfaction

Group	*M*	*SD*	*N*
Feedback	3.68	.406	36
No Feedback	3.66	.382	39
Total	3.67	.392	75

Note. Table 2 shows the means and standard deviations of the posttest satisfaction scores for the feedback and no feedback groups. No statistically significant difference was found between the two groups, $F(1, 73) = 0.104$, $p = .748$.

Additionally, a Pearson correlation coefficient was computed to assess the linear relationship between the knowledge pretest and posttest. There was a positive correlation between the two variables, $r = .694$, $p < .001$. Also, a Pearson correlation coefficient, computed to assess the linear relationship between knowledge posttest and satisfaction, showed a positive correlation and was statistically significant, $r = .294$, $p = .010$.

Analysis of the Follow-Up Questions on the Performance Questionnaire

Because there were no overall statistically significant effects of the intervention, I decided to probe the data further for any other potentially useful findings. There were no hypotheses for these follow-up analyses. I categorized the questions on the performance questionnaire according to three more specific topics.

Questions 1 through 7 addressed knowledge about independent and dependent variables. Questions 8 through 14 addressed knowledge about experimental and nonexperimental research. Questions 15 through 20 addressed knowledge about the three necessary conditions for making claims of cause and effect. To check for internal consistency reliability, I computed Cronbach alpha coefficients for each of the three sets of questions. The alpha coefficient for questions 1 – 7 was .775 indicating an acceptable reliability for the items measuring knowledge of independent and dependent variables. The alpha coefficient for questions 8 – 14 was .715 indicating an acceptable reliability for the items measuring knowledge of experimental and nonexperimental research. The alpha coefficient for questions 15 – 20 was .633 reliability for the items measuring knowledge of the three necessary conditions for making claims of cause and effect.

After checking for possible violations of any assumptions for ANCOVA, ANCOVAs were conducted on the posttest knowledge scores (controlling for pretest differences) for each of the sets of questions.

I first conducted an ANCOVA for items 1 – 7. The difference between the two groups was not statistically significant, $F(1, 84) = 56.7717$, $p < .001$. Next, I conducted a paired samples or dependent *t* test to determine if, for the two groups combined, the pretest ($M = .69$) was significantly different from the posttest ($M = .74$). The difference between these two means was 0.301.

Table 3

Descriptive Statistics for Knowledge About Independent and Dependent Variables (Questions 1 – 7)

Group	Percent Correct At Pretest	*SD*	Percent Correct at Posttest	*SD*	*N*
Feedback	.694	.308	.735	.263	42
No Feedback	.693	.271	.748	.291	46
Total	.693	.288	.742	.276	88

Note. Table 3 shows pretest and posttest percent correct and standard deviation for knowledge about independent and dependent variables for the feedback and no feedback groups. No statistically significant difference was found, $F(1, 84) = 56.7717$, $p < .001$.

Next, for the experimental/nonexperimental set of questions, the homogeneity of variances assumption of the ANCOVA was tested and met according to the Levene's test ($p = .0633$). The normality assumption was not met according to the Shapiro-Wilk test ($W = 0.909$, $p < .001$). The difference between groups was not statistically significant, $F(1, 84) = 3.16$, $p = .079$. The means and standard deviations for the two groups are shown in Table 4.

Table 4

Descriptive Statistics for Knowledge About Experimental and Non-Experimental Designs (Questions 8 – 14).

Group	Percent Correct At Pretest	*SD*	Percent Correct at Posttest	*SD*	*N*
Feedback	.748	.246	.738	.277	42
No Feedback	.780	.227	.770	.230	46
Total	.765	.235	.755	.253	88

Note. Table 4 shows pretest and posttest percent correct and standard deviation for knowledge about experimental and non-experimental designs for the feedback and no feedback groups. No statistically significant difference was found, $F(1, 84) = 3.16$, $p = .079$.

Next, assumptions were checked for the final category, causation. The homogeneity of variances assumption of the ANCOVA was met according to the Levene's test ($p = .520$). The normality assumption was met according to the Shapiro-Wilk test ($W = 0.982$, $p = .252$).

The difference between the groups was not statistically significant, $F(1, 84) = 0.0789$, $p = .779$. Table 5 shows the means and standard deviations for the two groups.

Table 5

Descriptive Statistics for Knowledge About the Three Necessary Conditions for Making Claims about Cause and Effect (Questions 15 – 20).

Group	Percent Correct At Pretest	*SD*	Percent Correct at Posttest	*SD*	*N*
Feedback	.583	.245	.591	.276	42
No Feedback	.609	.277	.576	.248	46
Total	.597	.261	.583	.261	88

Note. Table 5 shows pretest and posttest percent correct and standard deviation for knowledge about conditions for causation for the feedback and no feedback groups. No statistically significant difference was found, $F(1, 84) = 0.0789$, $p = .779$.

Next, I examined results by course enrollment. As described in Chapter III, participants were enrolled in one of three courses: an undergraduate course in research methods in psychology, an undergraduate course in educational technology, or an interdisciplinary graduate course in research methods. Prior to running the ANCOVAs, assumptions of the statistical test were checked. The assumptions were met for all three courses.

Psychology Course

For the psychology course for the set of independent variable/dependent variable questions, posttest scores did not differ by group, $F(1, 42) = 0.0433$, $p = .836$. For the experimental/nonexperimental set of knowledge questions, the difference between the

groups was not statistically different, $F(1, 42) = 1.05$, $p = .311$. For the set of causation questions (items 8-14) the difference between the groups was not statistically significant, $F(1, 42) = 1.098$, $p = .301$. For the total combined posttest scores, the difference was not statistically significant, $F(1, 42) = .08$, $p = .779$. For the satisfaction questionnaire, the group difference was not statistically significant, $F(1, 33) = 0.00$, $p = .953$.

Research Methods Course

In the graduate level research methods course for the set of independent variable/dependent variable questions posttest scores, the difference between the groups was not statistically significant, $F(1, 33) = 1.83$, $p = .186$. For the experimental/nonexperimental set of questions, the difference between the groups was not statistically significant, $F(1, 33) = 2.16$, $p = .151$. For the set of causation questions, the difference was not statistically significant, $F(1, 33) = 2.46$, $p = .126$. For the total posttest scores, the difference was not statistically significant, $F(1, 33) = 0.823$, $p = .371$. For the satisfaction questionnaire, the difference between the groups was not statistically significant, $F(1, 35) = 1.12$, $p = .297$.

Educational Technology Course

Because there were only five cases in the Educational Technology course, no significance testing was conducted. However, the means are shown in Table 6.

Table 6

Descriptive Statistics by Course Enrollment

Group	Percent Correct at Pretest	*SD*	Percent Correct at Posttest	*SD*	*N*
Psychology					
Feedback Group					
IV/DV	.807	.219	.807	.203	20
Exp/Non-Exp	.821	.222	.807	.193	20
Causation	.658	.232	.642	.282	20
Total	.755	.244	.814	.233	20
Satisfaction			3.86	.314	14
No Feedback Group					
IV/DV	.714	.259	.819	.257	26
Exp/Non-Exp	.802	.210	.786	.229	26
Causation	.635	.294	.564	.259	26
Total	.721	.216	.731	.217	26
Satisfaction			3.86	.314	21
Research Methods					
Feedback Group					
IV/DV	.647	.331	.722	.284	19
Exp/Non-Exp	.729	.238	.692	.327	19
Causation	.535	.246	.553	.284	19
Total	.664	.313	.703	.290	19
Satisfaction			3.56	.402	19
No Feedback Group					
IV/DV	.683	.300	.683	.304	18
Exp/Non-Exp	.770	.251	.778	.197	18
Causation	.611	.229	.611	.229	18
Total	.692	.216	.694	.182	18
Satisfaction			3.43	.312	18

Table 6 (cont'd)

Educational Technology					
Feedback Group					
IV/DV	.238	.218	.333	.0825	3
Exp/Non-Exp	.381	.0825	.571	.378	3
Causation	.389	.354	.500	.354	3
Total	.333	.0289	.467	.153	3
Satisfaction			3.64	.553	3
No Feedback Group					
IV/DV	.500	.101	.429	.404	2
Exp/Non-Exp	.571	.202	.500	.505	2
Causation	.343	.217	.371	.217	2
Total	.450	.141	.450	.424	2
Satisfaction			3.91	.643	2

Note. Table 6 shows pretest and posttest percent correct and standard deviation for the feedback and no feedback groups in each of the three courses in the study (psychology, research methods, and educational technology. No significance testing was done for the educational technology course due to the small number of participants. No statistically significant difference was found, $F(1, 84) = 3.16$, $p = .079$.

For the psychology course, no statistically significant differences between the groups were found for performance, $F(1, 42) = .08$, $p = .779$ or satisfaction $F(1, 33) = 0.00$, $p = .953$.

For the research methods course, no statistically significant differences between the groups were found for performance, $F(1, 33) = 0.823$, $p = .371$ or satisfaction $F(1, 35) = 1.12$, $p = .297$.

Chapter Summary

This chapter provides an overview of the study and presented the results from the quantitative data analyses for the two research questions and hypotheses. The findings did not support Hypotheses 1 and 2. Chapter V discusses the findings by research question. It also explores recommendations and implications of the findings. Finally, limitations are identified, and recommendations for future research are presented.

CHAPTER V

DISCUSSION

This dissertation investigated the effect of online case-based instruction with and without feedback on student performance and satisfaction with instruction. Details of the results from data analyses based on the two research questions and each corresponding hypothesis were presented in Chapter IV. Chapter V includes a discussion of all of the findings, study limitations, and recommendations for further research.

Summary of the Study

The purpose of this study was to determine if students who received online CBI in a research methods module with feedback would score higher on a posttest and satisfaction questionnaire, compared to students who received the same CBI without feedback. To conduct this study, participants were recruited from three courses: an undergraduate psychology course in research methods; a graduate interdepartmental course in research methods; and an undergraduate course in educational technology. Participants were randomly assigned to either the experimental group and received the CBI with feedback, or a control group and received the same CBI but without feedback. All participants completed a pretest about research methods prior to the intervention. Both groups completed an identical posttest and a satisfaction with instruction questionnaire after the intervention. All participants completed all assessments with the

exception of eleven students who were not present to complete the satisfaction questionnaire in the psychology course.

Discussion of Results/Major Findings

Achievement

Research Question 1 asked if there a difference in student test performance when using an online case-based study approach with feedback, compared to an online case-based study approach without feedback in research methods instruction. It was hypothesized that students who use case-based instruction with feedback would have higher test performance than students who receive the case-based instruction without feedback. Data from descriptive statistics and an ANCOVA did not support Hypothesis 1.

Satisfaction with Case-Based Instruction

Research Question 2 asked if there is a difference in student satisfaction when using an online case-based study approach with feedback, compared to an online case-based study approach without feedback in research methods instruction. It was hypothesized that students who used case-based instruction with feedback would have greater satisfaction with learning research method topics than students who received case-based instruction without feedback. The results of descriptive statistics and an ANOVA showed that hypothesis 2 was not supported by the data.

Other Observations

I observed a difference in the pretest scores of the three classes. The mean score for the psychology class was .741. For the research methods course, the mean score was .667, and for the educational technology class the mean was .380. The comparison of the three classes is very informative. The two research methods classes performed well at

pretest and did not improve. The educational technology class was low at pretest and the feedback group improved and the no feedback group did not improve. The sample is too small to make meaningful conclusions.

Relationship of the Findings to the Literature Review

Research results on the effectiveness of CBI have been mixed. Nevertheless, the literature review conducted for this study provided general support for the expectation of statistically significant improvements in performance and satisfaction. One example is the study reported by Thistlewaite et al. (2012), which found improved learning outcomes, as well as improved motivation and engagement, among healthcare students in a CBL course. Likewise, the study by Nicklen et al. (2016) described in Chapter II, found that CBL in an undergraduate physiotherapy course, whether delivered face-to-face or online, improved students' understanding and application knowledge. In contrast, the present study found no significant differences for performance or satisfaction between the with feedback and without feedback groups in the self-directed online CBI.

It was noted in other studies of online CBI that students preferred working individually instead of in a group with this type of course delivery. Participants in a study by Hayward and Cairns (2001) indicated that working with other students in online groups was stressful and they preferred to work alone in online CBI. Guest (2007) made a similar finding in a study of student performance and satisfaction in an educational psychology course. Students participated in individual online CBI, small-group online CBI, or traditional lecture-based instruction. The individual online CBI group reported the highest satisfaction of the three groups.

The current study used online individual CBI with all participants. Satisfaction was rated moderately high by participants in both the with feedback and without feedback groups, suggesting that students are more satisfied with the individual format for online CBI.

The literature review also found studies with no significantly significant differences in students' learning outcomes for CBL compared to lecture-based instruction (Kirschner et al., 2006; Uribe & Klein, 2003). In addition, some researchers noted that CBI is ineffective for some students and is influenced by specific learner characteristics such as goal orientation, levels of self-awareness, and openness to challenges (Ertmer et al., 1996).

Based on the literature, the expectation was that students find research methods courses highly challenging and anxiety-provoking. This did not appear to be the case with two of the samples for this study. Performance pretest scores show a relatively high average, .755 and .721 out of 1.000 respectively, for the feedback and no feedback groups in the Psychology course, and .664 and .692 for the Research Methods course. This may not be surprising for students enrolled in these two courses, because it is probable that they have had some experience with similar course content and concepts in previous courses. In addition, both the psychology and research methods courses covered the topics of the case prior to the commencement of the study. In the educational technology course, for which the research methods content is not central, lower pretest scores were obtained, with averages of .333 and .450.

Another possible explanation of no significant differences is that the intervention was simply ineffective. The literature review suggested that it is difficult to write case studies and design CBI (Hoffer, 2020).

Several studies for the literature review have claimed to find that feedback has a positive effect on learning outcomes and performance (Hyland, 2000; Van der Kleij et al., 2015). The present study included feedback characteristics that have been found to improve feedback delivery and effects. For example, LMSs facilitate the integration of immediate feedback into a course (Hatziapostolou & Paraskakis, 2010) and elaborated feedback is more effective for increasing the effect size of feedback, especially for higher order learning outcomes (Van der Kleij et al., 2015).

Limitations of the Study

There were several limitations in this study. Because there were only a few similar studies found in the literature, it may have been helpful to conduct a pilot study as a precursor to the present study.

One limitation was the small number of potential participants. For this reason, the original plan to conduct the study in a psychology course in research methods was expanded and students from three different courses, at both undergraduate and graduate levels, were invited to participate in the study. Originally, the research plan design also included an additional group with no case study, but this was not feasible due to the limited number of participants.

Differences among the courses contributed to some limitations. For example, only five students in the educational technology course participated in the study. In the graduate level course in research methods and the psychology research methods course, it

is quite possible that students were already familiar with the instructional content of the intervention, compared to the educational technology class. For both research methods courses, it is possible that lessons or reading ahead before the intervention could have contributed to strong performance on the pretest.

Another possible limitation was that feedback did not produce enough of a difference in the two versions of the intervention to be detectable through statistical analysis. Additionally, the intervention was brief. An inspection of the case-based instruction showed that students answered most (4.2) of the six questions, that were embedded in the case, correctly on the first attempt. Therefore, there was little opportunity to receive feedback in the feedback condition. The feedback manipulation was weaker than intended because the performance on the questions in the case-based instruction was quite good.

Previous research points to other possible contributing factors to this study's non-significant findings. For example, reflective thinking is seen as a major benefit of CBI (Jonassen & Hernandez-Serrano, 2002; Shulman, 1992). Instead of assessing only performance scores and student satisfaction with the instruction, perhaps this study should have used additional measures. For example, Rosen (2009) found that participants who received CBI scored much higher on the Reflective Thinking Scale, compared to participants who received non-CBI instruction. Other researchers (Hewitt et al., 2003; Hourigan, 2008; and Kleinfield, 1991) have found that CBI was beneficial in promoting reflective thinking in a variety of disciplines.

Suggestions for Future Research

Despite the findings of no significant differences between the experimental condition of online CBI with feedback in research methods instruction, and the control condition of online CBI without feedback, the literature review suggests that CBI can be effective in increasing learner performance and satisfaction. I suggest that future research in this area be conducted to avoid the limitations of this study. One suggestion is to use a multimedia presentation of the CBI intervention; research has shown this to be effective (Wolter et al., 2012).

Another suggestion is to incorporate strategies to facilitate emotional involvement into a case, which Shulman (1992) and Andrews et al. (2009) suggested is an important aspect of CBI that distinguishes it from other types of instruction.

Preexisting knowledge may have been a factor in the results of this study, so I suggest that further research use more obscure instructional content that participants would be unlikely to have any knowledge of.

I think that a study of CBI with the instructor as researcher would be more likely to produce significant results, due to full researcher control over the timing and length of study. This would allow for more pronounced differences between the levels of intervention, more distinction between treatment and control conditions, and possibly more flexibility in choosing delivery formats (Wilson & Alexander, 2021).

A possible area for further research is to supplement a posttest with an assessment to measure other learning outcomes in addition to test performance and satisfaction with the CBI. Previous researchers had identified benefits of technology-supported CBI, for example increased motivation (Hughes et al., 2000), enhanced knowledge transfer

(Baker, 2009), and real-life problem-solving ability (Choi & Lee, 2009). In addition, reflective thinking is accepted as a purpose and a benefit of CBI (Jonassen & Hernandez-Serrano (2002); Shulman (1992). Therefore, an assessment of reflective thinking improvement associated with CBI is suggested for future research.

Finally, I suggest a lengthier CBI intervention for future studies. Similar to the results of the present study, Guest (2007) also found no statistically significant differences among groups in a CBI intervention. One of the potential reasons she proposed was a short instruction time. It could be informative to incorporate self-directed online CBI into a semester-length course.

Chapter Summary

In this chapter I discuss the findings in this study. The findings from the study are discussed for each research question and hypothesis. The limitations of the study are presented and recommendations for future research are provided.

This study differed from most of the reviewed research on CBI, because it focused on CBI's delivery as self-directed online instruction. Specifically, the study examined the effect of feedback in the context of self-directed online CBI in a research methods module. The literature review found only three studies that had investigated CBI in this format. Therefore, the strengths and weaknesses of this instructional approach have not been thoroughly researched and documented, and there was scant precedent for investigation of this topic.

Possible reasons for the findings of non-significant differences were proposed and discussed. There were no statistically significant findings for the two research questions,

and analysis of follow-up questions found no statistically significant findings based on course or topic of performance assessment questions.

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APPENDICES

Appendix A:

CONSENT FORM TO PARTICIPATE IN RESEARCH STUDY

Title of Project: The Use of Case Studies in a Research Methods Course

Principal Investigator: Anthony Wheeler, amw1004@jagmail.southalabama.edu

Advisor: Dr. Burke Johnson, Department of Counseling and Instructional Sciences

You are invited to participate in a research study about using case studies to teach research methods. Your participation in this study is completely voluntary, and will take approximately 40 minutes total over two online sessions. You will be asked to complete a pretest, an online instructional session about research methods, and a posttest.

Risks: To the best of my knowledge, there are no risks associated with this study.

Potential Benefits: There may be no personal benefit from your participation, but the information gained by doing this research may help others in the future.

Confidentiality: Your responses to this questionnaire will be confidential and any reporting of the data will be in aggregate form. All data will be kept for two years. The data will be stored securely in a password protected computer and on a password-protected backup drive.

Voluntary Participation: Your participation in this research study is completely voluntary. You do not have to participate. You may quit at any time without any penalties.

Contacts and Questions: If you have questions about this study, please contact Anthony Wheeler (amw1004@jagmail.southalabama.edu). For questions about your rights as a research participant or to discuss other study-related concerns or complaints with

someone who is not part of the research team, you may contact the Institutional Review Board at 251-460-6308 or email irb@southalabama.edu

Consent: You have read, or have had read to you, and understand the purpose and procedures of this research. You have had an opportunity to ask questions which have been answered to your satisfaction. You voluntarily agree to participate in this research as described.

Click YES to proceed to the study.

Click NO to exit now.

Appendix B:

IRB Approval

irb@southalabama.edu

UNIVERSITY OF SOUTH ALABAMA

TELEPHONE: (251) 460-6308
AD 240 · MOBILE, AL. 36688-0002

INSTITUTIONAL REVIEW BOARD
September 1, 2021

Principal Investigator:	Anthony Wheeler		
IRB # and Title:	IRB PROTOCOL: 21-340 [1798136-1] An Investigation of case-based instruction with feedback in a research methods course		
Status:	APPROVED	Review Type:	Exempt Review
Approval Date:	September 1, 2021	Submission Type:	New Project
Initial Approval:	September 1, 2021	Expiration Date:	
Review Category:	**Exempt:** Category: 45 CFR 46.101 (2): Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior		

This panel, operating under the authority of the DHHS Office for Human Research and Protection, assurance number FWA 00001602, and IRB Database #00000286, has reviewed the submitted materials for the following:

1. *Protection of the rights and the welfare of human subjects involved.*
2. *The methods used to secure and the appropriateness of informed consent.*
3. *The risk and potential benefits to the subject.*

The regulations require that the investigator not initiate any changes in the research without prior IRB approval, except where necessary to eliminate immediate hazards to the human subjects, and that **all problems involving risks and adverse events be reported to the IRB immediately!**

Subsequent supporting documents that have been approved will be stamped with an IRB approval and expiration date (if applicable) on every page. Copies of the supporting documents must be utilized with the current IRB approval stamp unless consent has been waived.

Notes:

Appendix C:

Pre and Post Test
Case Study Research

Research Methods Module Pretest-Posttest Instrument*
*(Items 1-7 address IVs and DVs; items 8-14 address experimental vs. nonexperimental research; and items 15-20 address the three criteria required for claims of causation)

1. The variable that is presumed to cause changes in another variable is called a(n):
a. Categorical variable
b. Dependent variable
c. Independent variable
d. Expendent variable
Ans: c

2. The variable that is presumed to be influenced by one or more independent variables is called a(n):
a. Categorical variable
b. Dependent variable
c. Independent variable
d. Expendent variable
Ans: b

3. A researcher is interested in the effects of teaching students problem-solving strategies on
their abilities to solve complex mathematics problems. She randomly assigns students to either
learn the strategies, or participate in a control group. She then compares their performance on a
complex problem-solving task. The student performance scores on the complex problem task are the:
a. Independent variable
b. Dependent variable
c. Moderating variable
d. Mediating variable
Ans: b

4. A researcher is interested in the effects of a YouTube video on student learning of a topic in
statistics (e.g., how to calculate a correlation coefficient). He randomly assigns 50 students to one of two conditions. In one condition, the students read a traditional text. In the second condition, students view a YouTube video. He measures their performance on a posttest. In this scenario, type of instruction (text versus video) serves as the:

a. Independent variable
b. Dependent variable
c. Moderating variable
d. Mediating variable
Ans: a

5. A synonym for independent variable is:
a. Manipulated variable
b. Extraneous variable
c. Outcome variable
d. Confounding variable
Ans: a

6. A synonym for dependent variable is:
a. Manipulated variable
b. Extraneous variable
c. Outcome variable
d. Confounding variable
Ans: c

7. To determine whether noise affects the ability to solve math problems, a researcher has one group solve math problems in a quiet room and another group solve math problems in a noisy room. The group solving problems in the noisy room completes 15 problems in one hour and the group solving problems in the quiet room completes 22 problems in one hour. In this experiment, the independent variable is _____ and the dependent variable is _____.
a. The number of problems solved; the difficulty of the problems
b. The number of problems solved; the noise level in the room
c. The noise level in the room; the number of problems solved
d. The noise level in the room; the difficulty of the problems
Ans: c

8. Researchers who want to design strong research studies that can support cause and effect conclusions should, if possible, use which of the following?
a. Nonexperimental research
b. Experimental research
c. Correlational research
d. Ethnography research
Ans: b

9. _____ research occurs when the researcher manipulates the independent variable.
a. Nonexperimental research
b. Experimental research
c. Grounded theory research
d. Historical research

Ans: b

10. Nonexperimental research cannot involve which of the following?
a. Manipulation of an independent variable
b. Data collection from multiple kinds of people
c. More than one variable
d. Descriptions of the relationships between variables
Ans: a

11. Which of the following examples illustrates experimental research?
a. A researcher studies the profiles of National Merit Scholars to determine what factors are
associated with their success
b. A researcher does a study where she manipulates the types of memory strategies students are taught and then measures their recall
c. A researcher does a study where he examines the correlation between mathematics anxiety and time to solve a mathematics story problem set
d. A researcher does a study where she carries out a survey that quantifies student beliefs about mathematics and follows that study up with a series of qualitative interviews with students
Ans: b

12. Which of the following is an example of nonexperimental research?
a. A researcher manipulates how students are taught statistics and then looks at the performance differences on a posttest
b. A researcher manipulates how students are taught to solve word problems and compares math performance on a test
c. A researcher looks at the correlation between reading speed and reading comprehension
d. A researcher assigns students with ADHD to one of two drug treatment groups and examines the impact of the drug conditions on ADHD symptoms
Ans: c

13. A researcher studies the relation of social media use to anxiety by having a large group of college students complete a questionnaire that includes questions about social media use and anxiety. The researcher finds that students who report greater social media use also report higher levels of anxiety. This is a(n) _____ study.
a. Experimental
b. Nonexperimental
c. Qualitative
d. Placebo controlled
Answer: b

14. A researcher randomly assigns 100 participants to two groups (resulting in 50 in each group).
Group 1 completes homework each day for 5 days; Group 2 completes the same 5 homework assignments all in one day. The researcher then tests both groups' knowledge of the content covered in the homework. This is a(n) _____ study.
a. Experimental
b. Nonexperimental
c. Qualitative
d. Correlational
Answer: a

15. Which of the three required conditions for cause and effect is relatively easy to establish in nonexperimental research?
a. Condition 1 (relationship)
b. Condition 2 (proper time order)
c. Condition 3 (lack of alternative explanation)
d. All three conditions are quite easy to establish
Ans: a

16. A researcher has 500 Research Methods students at the University of South Alabama complete questionnaires where they rate their sleep habits for the semester and report their anxiety for the semester. The researcher finds that students who report sleeping less also report greater anxiety. Evaluate this study using the three criteria for cause and effect relationships.
a. We see that sleep is related to anxiety and that sleep problems occurred before anxiety, so we can be confident that the sleep problems are the cause of the anxiety.
b. We see that sleep is related to anxiety so we can be confident that the sleep problems are the cause of the anxiety.
c. We see that sleep is related to anxiety, but we do not know if the sleep or the anxiety came first. We also do not know if there might be another variable (like depression) that is causing low sleep and high anxiety. We cannot be confident that sleep problems are the cause of anxiety.
d. all of the above
Answer: c

17. How well do experiments with random assignment address the third criterion for Cause and Effect? That is, how well do they rule out alternative explanations of why the independent and dependent variables are related?
a. They are poor at ruling out alternative explanations because they can only demonstrate simple relationships
b. They are poor at ruling out alternative explanations because they control what happens in the experiment.
c. They are good at ruling out alternative explanations because random assignment is the best way to make sure the groups are equal at the beginning of the study. Then if the

groups are different on the dependent variable, we can be more confident that the independent variable caused that difference (because the groups were not different before the independent variable was introduced).
d. They are good at ruling out alternative explanations because they control for only one extraneous variable.
Answer: c

18. The second criteria for establishing cause and effect relationships is "Temporal Order." A
study that has appropriate temporal order _____.
a. measures the IV and DV at the same time
b. measures (or manipulates) the IV considerably before the DV
c. measures the IV first for half of the participants and measures the DV first for the other half of the participants.
d. measures the DV before the IV for all participants.
Answer: b

19. If we conduct a nonexperimental research study and find that using social media is related to anxiety, which of the following is a reasonable alternative explanation that would need to be ruled out and why?
a. we would need to rule out the variable of loneliness because loneliness may cause both social media use and anxiety.
b. we would need to rule out stress, because stress can lead to anxiety
c. we would need to rule out income because income problems can lead to anxiety
d. we would need to rule out romantic relationship problems because romantic problems can lead to anxiety.
Answer: a

20. A researcher has 500 college students participate in her study. The students complete a questionnaire that includes questions about romantic relationships. Participants report how long they have been in their current romantic relationship and how satisfied they are with their current romantic relationship. The findings indicate that length of relationship is related to satisfaction. That is, people who report a longer relationship also report higher satisfaction and people who report a shorter relationship report lower satisfaction. What should we conclude?
a. we should conclude that satisfaction causes relationship length (if you are satisfied, you stay in the relationship).
b. we should conclude that relationship length causes satisfaction (if you stay in the relationship, you become more satisfied over time).
c. we should conclude that personality causes both relationship length and satisfaction (if you are easy going, your relationships last longer and you are more satisfied).
d. we should conclude that relationship length and satisfaction are related. However, based on this study, we do not know why they are related.
Answer: d

Appendix D:

Online Module Satisfaction Questionnaire

Case Study Research

Please answer questions 1 - 11 by indicating the response that most closely fits your opinion.

1. The online research module instruction was clear.				
Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
2. The online research module was easy to navigate.				
Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
3. The content of the online research module was engaging.				
Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
4. I feel the online research module was interesting.				
Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
5. I feel the online research module was informative.				
Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
6. The online research module captured my attention.				
Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
7. I believe the online research module was easy to follow.				
Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
8. I did not like the online research module.				
Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
9. I was satisfied with the module.				
Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
10. I think the online research module was boring.				
Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
11. I feel more motivated to learn about research methods after this case study.				
Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**

Appendix E:

Case Study without Feedback

A Case Study in Research Methods

In the following case study, two students will examine a claim that listening to music will improve their cognitive skills and attitude.

“Hey, Jesse, what are you listening to?” asked Taylor.

“I’m listening to this music that’s supposed to help me concentrate more and become more creative,” answered Jesse.

Taylor is skeptical. “How can listening to music do all that? Where did you hear about this?”

“Well, I read an article the other night that said music is supposed to stimulate the right side of your brain and improve your ability to concentrate. They said that some researchers found that listening to music made people do better on different mental tests and that it makes your brain release these chemicals that make you feel better” Jesse said excitedly.

Taylor is still skeptical about Jesse’s new music listening habit. “What else did the article say?”

“All sorts of cool things. Like, when they played the music for these cows, they gave more milk” said Jesse.

Taylor laughs. “So, have you been giving more milk or what?”

“Hey, don’t laugh. I haven’t been doing so great in some of my classes so I figured I might as well give it a chance,” Jesse answered.

Taylor and Jesse decide to investigate the article’s claims for their research methods class project. They want to answer the following questions that they believe will help them in planning a research study.

You need to design a research study that answers Taylor and Jesse’s question, which is “Does listening to music cause students to learn the assigned material better than not listening to music?”

Now, please think about how you would design a research study to provide excellent evidence of cause and effect for the above causal research question.

1. What research approach would you use in your study?
    a. Experimental research
    b. Nonexperimental quantitative research
    c. Qualitative research
2. What is your independent variable?
    a. Listening to music (or not)
    b. Test scores
    c. The participants
    d. Age
3. What is your dependent variable?
    a. Listening to music (or not)
    b. Test scores
    c. The participants
    d. Age
4. How would you do your research study?
    a. Obtain a sample of 250 college students. Randomly assign these students to the conditions of "listen to music while studying" and "not listen to music while studying." After 30 minutes, test the students in both groups on how much they learned.
    b. Conduct a survey of 250 students, have them report how often they listen to music while studying, and report their grades.

c. identify the highest performing student in your class, and interview them about their music listening habits.

5. How well does an experimental research study with random assignment meet the three criteria for causation?
    a. It only shows the presence of a relationship between the independent and dependent variables.
    b. It only shows the presence of a relationship between the independent and dependent variables, shows time ordering of the variables, and rules out alternative explanations.
6. How well does a non-experimental quantitative (i.e., correlational) research study (where students report their music listening habits and their grades on a questionnaire) meet the three criteria for causation?
    a. It only shows the presence of a relationship between the independent and dependent variables.
    b. It only shows the presence of a relationship between the independent and dependent variables and the correct time ordering of the variables.
    c. Shows the presence of a relationship between the independent and dependent variables, shows correct time ordering of the variables, and rules out alternative explanations.

Appendix F:

Case Study with Feedback

A Case Study in Research Methods

In the following case study, two students will examine a claim that listening to music will improve their cognitive skills and attitude.

"Hey, Jesse, what are you listening to?" asked Taylor.

"I'm listening to this music that's supposed to help me concentrate more and become more creative," answered Jesse.

Taylor is skeptical. "How can listening to music do all that? Where did you hear about this?"

"Well, I read an article the other night that said music is supposed to stimulate the right side of your brain and improve your ability to concentrate. They said that some researchers found that listening to music made people do better on different mental tests and that it makes your brain release these chemicals that make you feel better" Jesse said excitedly.

Taylor is still skeptical about Jesse's new music listening habit. "What else did the article say?"

"All sorts of cool things. Like, when they played the music for these cows, they gave more milk" said Jesse.

Taylor laughs. "So, have you been giving more milk or what?"

"Hey, don't laugh. I haven't been doing so great in some of my classes so I figured I might as well give it a chance," Jesse answered.

Taylor and Jesse decide to investigate the article's claims for their research methods class project. They want to answer the following questions that they believe will help them in planning a research study.

You need to design a research study that answers Taylor and Jesse's question, which is "Does listening to music cause students to learn the assigned material better than not listening to music?"

Now, please think about how you would design a research study to provide excellent evidence of cause and effect for the above causal research question.

1. What research approach would you use in your study?

    a. Experimental research

- This is correct! Experiments are excellent for studying cause and effect relationships.
- Continue to question 2.

    b. Nonexperimental quantitative research

- This is not correct. Nonexperimental research provides good evidence about relationships but is not the best method for studying cause and effect.
- If you answered b, go back to question 1.

    c. Qualitative research

- This is not correct. Qualitative research does not examine questions about causation between variables.
- If you answered c, go back to question 1.

2. What is your independent variable?

    a. Listening to music (or not)

- That is correct! The independent variable is the causal variable.
- Continue to question 3.

    b. Test scores

- This is not correct. Remember the independent variable is the causal variable.
- If you answered b, go back to question 2.

c. The participants

- This is not correct. Remember the independent variable is the causal variable.
- If you answered c, go back to question 2.

d. Age

- This is not correct. Age would be a possible extraneous variable, not the independent variable.
- If you answered d, go back to question 2.

3. What is your dependent variable?

a. Listening to music (or not)

- This is not correct. Remember the dependent variable is the outcome variable.
- If you answered a, go back to question 3.

b. Test scores

- This is correct! The dependent variable is the outcome variable.
- Continue to question 4.

c. The participants

- This is not correct. Remember the dependent variable is the outcome variable. The participants are the individuals in the study.
- If you answered c, go back to question 3.

d. Age

- This is not correct. Age would be a possible extraneous variable, not the dependent variable.
- If you answered d, go back to question 3.

4. How would you do your research study?
    a. Obtain a sample of 250 college students. Randomly assign these students to the conditions of "listen to music while studying" and "not listen to music while studying." After 30 minutes, test the students in both groups on how much they learned.

- This is correct! Experiments with random assignment are the best for providing evidence of causation.
- Continue to question 5.

    b. Conduct a survey of 250 students, have them report how often they listen to music while studying, and report their grades.

- This is incorrect. Surveying students is a nonexperimental research approach and is good for seeing relationships but not for studying causation.
- If you answered b, go back to question 4.

    c. Identify the highest performing student in your class, and interview them about their music listening habits.

- This is incorrect. This would be qualitative approach which is very poor for studying cause and effect between variables.
- If you answered c, go back to question 4.

5. How well does an experimental research study with random assignment meet the three criteria for causation?
    a. It only shows the presence of a relationship between the independent and dependent variables.

b. It only shows the presence of a relationship between the independent and dependent variables, and the correct time ordering of the variables.

- This is incorrect. Experiments do show relationships, but experiments do much more which is necessary for making claims about cause and effect.
- If you answered a, go back to question 5.

c. It only shows the presence of a relationship between the independent and dependent variables, and the correct time ordering of the variables.

- This is incorrect. Experiments show relationships and time order (because the independent variable comes before the dependent variable), but experiments do much more which is necessary for making claims about cause and effect.
- If you answered b, go back to question 5.

d. It shows the presence of a relationship between the independent and dependent variables, shows time ordering of the variables, and rules out alternative explanations.

- This is correct! Experiments with random assignment do very well on all three of the required criteria for cause and effect.
- If you answered c, continue to question 6.

6. How well does a non-experimental quantitative (i.e., correlational) research study (where students report their music listening habits and their grades on a questionnaire) meet the three criteria for causation?

a. It only shows the presence of a relationship between the independent and dependent variables.

b. It only shows the presence of a relationship between the independent and dependent variables and the correct time ordering of the variables.

- That is correct! We might see that as time listening to music increases test scores increase, but we do not establish correct time order and there are multiple alternative explanations that would need to be ruled out.

c. It only shows the presence of a relationship between the independent and dependent variables and the correct time ordering of the variables.

- This is incorrect. We can show a relationship, but we will not know if listening to music or test scores came first.
- If you answered b, go back to question 6.

d. Shows the presence of a relationship between the independent and dependent variables, shows correct time ordering of the variables, and rules out alternative explanations.

- This is incorrect. We can show a relationship, but we will not know if listening to music or test scores came first, and, importantly, we do not know if there are other reasons why listening to music and test scores might be related.
- If you answered c, go back to question 6.

BIOGRAPHICAL SKETCH

BIOGRAPHICAL SKETCH

Anthony M. Wheeler was born in Mobile, Alabama. He graduated from the University of South Alabama, Mobile, Alabama, with a Bachelor of Arts in Broadcast Journalism in 2015. He graduated from the University of South Alabama with a Master of Arts in Mass Communication in 2017. In 2022, he was awarded a Doctor of Philosophy degree in Instructional Design and Development by the University of South Alabama.