December 2020

DEVELOPING COGNITIVE FLEXIBILITY AND PROJECT MANAGEMENT JUDGMENT: USING ONLINE PROGRESSIVE CASES TO INTRODUCE REALISTIC AND UNEXPECTED CHALLENGES

Lina Souid
Syracuse University

Abstract

A project is a finite activity aimed at producing a tangible product or service. Designing and developing instruction is a type of *project.* Instructional design projects (*design projects)* require instructional designers (IDs) to manage multiple and often overlapping work tasks, balance the *triple constraint* (time, budget, and quality), and react to project changes. Thus, *project management* (PM) is a critical aspect of instructional designer competencies.

Traditionally, professional development (PD) involves the use of *cases* that present a complex, realistic problem for learners to discuss. Most of these cases are *static;* the problem does not change during the learning process. Static cases do not engage learners in anticipating and resolving project changes, including client requests for scope additions, or changes in budget or timelines; therefore, novice IDs and project managers (PMs) are often ill-prepared to work on real-world, complex, dynamic projects.

PD should engage learners in *thought and action* around *messy* project problems. *Zingers,* realistic and unexpected challenges, were introduced while graduate students were developing a PM plan for a design project. These zingers were designed to simulate the complex, dynamic real-world practice of PM within instructional design (ID) work.

This dissertation study aimed to inform the design of instruction to develop the expert-like thinking strategies and practice strategies required to respond to unexpected events and solve messy problems. The *case study research method (CSRM)* was used to *describe* the learning process during the *progressive case* by tracking participants' flexible thinking (cognitive flexibility [CF]) and PM judgment in *thought* and *action dimensions* over a semester.

In general, the selected teams approached the zingers differently. In most cases, teams made optimistic assumptions, did not balance constraints, and submitted PM plans with internal inconsistencies. While teams had difficulty executing responses to unexpected changes on their PM plans, they exhibited flexible thinking and an understanding of PM concepts in their reflections and discussions. Thus, participants demonstrated more CF than PM judgment, and their *thoughts* exhibited more CF and PM judgment than their *actions*.

Keywords: Instructional design, project management, online learning, case-based method, case-based instruction, progressive case, cognitive flexibility, project management judgment, unexpected events, training

DEVELOPING COGNITIVE FLEXIBILITY AND PROJECT MANAGEMENT JUDGMENT: USING ONLINE PROGRESSIVE CASES TO INTRODUCE REALISTIC AND UNEXPECTED CHALLENGES

By

Lina Souid

B.A. B.S. Syracuse University, 2007

M.A. Western Governor's University, 2011

M.S. Syracuse University, 2014

Dissertation

Submitted in partial fulfillment of the requirement for the degree of Doctor of Philosophy (Ph.D.) in Instructional Design, Development, and Evaluation.

Syracuse University
December 2020

Acknowledgements

This dissertation is dedicated to all learners who will be united by knowledge and will use their knowledge to make the world a better place.

This dissertation study was completed through the support of a village:

- Dr. Tiffany A. Koszalka, thank you for teaching me what matters; providing endless opportunities to collaborate, practice, and grow; and encouraging me to challenge the status quo and strive for excellence.
- Dr. Nick Smith, thank you for teaching me how to think critically. I still ask myself and others, “So what?”, Who cares?”, and “How do you know that?”.
- Dr. Jing Lei, I always appreciate your support and positive attitude. I try to emulate you every day.
- Linda Tucker and Rebecca Pettit, thank you both for your help with all the things that come up on a daily basis.
- Stephanie Costner, thank you for encouraging me to enter the Instructional Design field. You taught me what real-world work looks like and how to lead with my heart.
- Dr. Pat Greer and Dr. Michelle Kruse-Crocker, thank you both for your friendship and advice while I juggled a full-time job and dissertation work.
- Rebekah Cooper, Tara Brown, and my work friends, thank you for cheering me on and giving me endless opportunities for self-development. Here’s to: “Do the right thing, do whatever it takes, and have fun.”.
- All my IDD&E friends, especially, Dr. Jimmy Jang, Dr. Jacob Hall, Vivi Wu, Dr. Chris Hromalik, and Mary Wilhelm-Chapin, thank you for making this journey more fun. We learned so much together and I hope we get to see each other again soon.

- My parents, Dr. Abdul K. Souid and Dr. Faten Souid, and family, thank you for giving me the resources, time, and support to do this work. Thank you for instilling the value of education in me at an early age.
- My husband, Dr. Ahmad Kassabji, thank you for your support, encouragement, and love.

Table of Contents

List of Illustrative Materials

Tables

Figures

Chapter 1: Introduction

Research Overview

Instructional designers (IDs), by definition, create instruction using a systematic process and *manage* the design, development, and/or enhancement of instructional *products* (Reiser, 2001). They often work with multiple types of resources (ex. technology, staff); collaborate (Davis & Radford, 2014) and negotiate with stakeholders (S. M. Kim, 2015); and produce products given specific standards, or *constraints* (Williams van Rooij, 2009; York & Ertmer, 2011). Three critical constraints (time, cost, and quality) need to be balanced when managing Instructional Design (ID) projects (*design projects)* (Williams van Rooij, 2010; York & Ertmer, 2011). These constraints pose competing demands on a project, with the tension among them commonly referred to as the *triple constraint* (Maley, 2012; Project Management Institute, 2004).

Design projects benefit from the development and use of a *project management (PM) plan* (Cennamo & Kalk, 2005; Smith & Ragan, 1999). PM plans outline work to be done (*scope*), available and required resources, timelines for tasks, and quality checkpoints (Project Management Institute, 2017). It is suggested that IDs who are successful in planning and carrying out design projects demonstrate competence in PM; specifically competence to collaborate with stakeholders, manage priorities and constraints in a project, and resolve project issues (Koszalka et al., 2013).

Project issues (ex. *unexpected events or changes)* often emerge after initial PM plans are drafted and may impact project success (Geraldi et al., 2010). Project constraints and resources may change (Geraldi et al., 2010; Jonassen, 2008; S. M. Kim, 2015; Olsson, 2006). For example, the client may modify deadlines, reduce the budget, or request additional deliverables.

Successful responses to unexpected events and changes require *flexible thinking* (Dainty et al., 2005; Jaafari, 2003; Olsson, 2006; Rowland et al., 1994; Yanchar & Gabbitas, 2011) and *judgment skills* (Gray et al., 2015; Perez & Emery, 2008). These thinking and practice strategies do not necessarily emerge naturally; rather may require IDs to participate in professional development (PD) experiences.

PM literature from business and software contexts can serve as a model to prepare IDs for PM responsibilities. This literature provides insights on PM practice and PD methods to enhance project managers' (PMs) competencies in managing complex, dynamic projects.

Literature suggests that using *cases* (e.g., real or hypothetical problems) in PD can help novice PMs (Córdoba & Piki, 2012; Jennings, 2002; Ramazani & Jergeas, 2015) and IDs (Bennett, 2010; Julian et al., 2000; Sugar, 2014) develop competencies. *Static cases* dominate the teaching practice (*case-based method* (CBM)) as described in seminal works in business (Barnes et al., 1994) and ID contexts (Ertmer & Russell, 1995). Static cases are a snap-shot of an incident (Hudspeth & Knirk, 1989) and provide rich information about a real or hypothetical situation to prompt discussion (Barnes et al., 1994). Yet, static cases do not change during the learning process. Thus, learners are not naturally *engaging* in flexible thinking as they work through the case, nor are they prompted to practice modifying PM plans in response to project changes as would be required in practice. The "neatening" (Spiro et al., 1987) of PD calls to question how well prepared these learners are to tackle real-world, complex, dynamic projects.

In this dissertation study, *progressive cases*, cases with emerging or changing constraints, were integrated in an online, graduate-level, PM course to support the development of flexible thinking and PM judgment during PM planning activities. To simulate real-world PM practice, *zingers,* or realistic and *unexpected* challenges, were introduced in different parts of the case, interrupting students' work. For example, in the middle of the PM planning process the client requested a change in scope (e.g., add more features to the product) and timeline (e.g., deliver the product sooner). Students were tasked to demonstrate how they adjusted their thinking, judgments, and PM plan in response to these challenges. The goal, therefore, was to *describe* what students thought and did to respond to zingers by tracking their flexible thinking and PM judgment during the progressive case.

Statement of the Problem

Overview of the Problem

Real-world projects are *complex* and *dynamic* (Geraldi et al., 2011). Research suggests that both novice PMs and novice IDs are ill-prepared to deal with the *messy* projects they will encounter in the workplace (Aram & Noble, 1999; Jonassen & Hernandez-Serrano, 2002; Rowland et al., 1992; Thomas & Mengel, 2008). Current approaches to teaching PM and ID often involve *static cases* that do not engage novices in the complex, dynamic nature of projects (Bannan-Ritland, 2001; Thomas & Mengel, 2008). While static activities can provide vicarious experience (Jonassen & Hernandez-Serrano, 2002; Tawfik & Jonassen, 2013) and help novices bridge theory and practice (Graf, 1991; Hudspeth & Knirk, 1989), they are often neatened and not reinforced with immediate practice that prompts learners to *respond to change by taking action*.

Real-World Projects are Messy

Both PM projects and design projects are complex and dynamic (Geraldi et al., 2011); that is, real-world projects are *messy. Complex* projects have many parts, and these parts are *interdependent* (Whitty & Maylor, 2009). Since variables in a project interact (Whitty & Maylor,

2009) and are contingent (Goel & Pirolli, 1992), a change in one part of a project may cause a ripple effect.

Also, PM projects (Geraldi et al., 2010, 2011; Hallgren & Maaninen-Olsson, 2005; Winter et al., 2006) and design projects (Gray et al., 2015; Jonassen, 2008; S. M. Kim, 2015; Tripp, 1994) are *dynamic* because they are often subject to unexpected events, or changing or emerging constraints.

Responding to Project Changes

According to international PM standards, when facing a project change, a PM has three main options: ignore the change (avoid), minimize the impact of the change (mitigate), or accommodate the change (accept) (Project Management Institute, 2017). Each of these options requires the PM to engage in flexible thinking and use PM judgment (Jaafari, 2003; Project Management Institute, 2017). First, the PM needs to identify the change (Butt et al., 2016). Second, the PM needs to adjust their thinking to consider the change and its potential impact and choose a response. Adjusting one's problem solving when the demands of the task change is part of *cognitive flexibility* (CF) (Krems, 1995). CF involves representing knowledge from multiple perspectives to allow for future, flexible thinking to deal with new problems (Spiro et al., 1992). Individuals who have strong CF are aware of alternatives and willing to be flexible to adapt to a situation (M. M. Martin & Rubin, 1995). Third, the PM's response must be grounded in PM judgment. In this dissertation study, individuals with PM judgment consider:

- how changes in one constraint affects other constraints (*triple constraint* (Maley, 2012; Project Management Institute, 2004)).

- how changes in one part of a project can affect other parts (*interdependent parts)*—resulting in the decision to rework or remove (Butt et al., 2016, p. 1581; Project Management Institute, 2017) parts of the PM plan.

Instructional Design Practice: Solving Ill-structured Design Problems

ID practice involves solving ill-structured design problems (Goel & Pirolli, 1992; Jonassen, 2000, 2008; Rowland et al., 1994; Tripp, 1994). Jonassen (2000) suggested that "design problems are usually among the most complex and ill-structured kinds of problems that are encountered in practice" (p. 80). Difficulties that arise during design problem solving include: high complexity (e.g., Goel & Pirolli, 1992), lack of information and feedback (e.g., Fortney & Yamagata-Lynch, 2013), and *interdependence* of design components (e.g., illogical connections between components of the problem that may result in contingencies) (Goel & Pirolli, 1992). Information regarding the product's goals, constraints, and/or success criteria may be missing (Jonassen, 2008; York & Ertmer, 2011), ill-defined/vague (Jonassen, 2000, 2008), or emerging (Jonassen, 2008; S. M. Kim, 2015). Thus, these conditions require problem structuring (Goel & Pirolli, 1992; Jonassen, 2000); adaption of knowledge to meet unique problem situations (Ertmer & Stepich, 2005); and iterative problem solving (Goel & Pirolli, 1992), planning (S. M. Kim, 2015), and design (Jonassen, 2008).

Consequently, ID practice requires *expert-like thinking strategies* (e.g., flexible thinking and judgment) to engage with and structure design problems, and *practice strategies* (e.g., flexible and iterative planning actions) to solve the problems by taking action.

Instructional Design Professional Development: Facilitating Transfer

To facilitate the *transfer* of learned skills to new settings, PD should reflect the problems practitioners encounter in *practice* (Sykes & Bird, 1992; Tracey & Boling, 2014). *Transfer* *problems* (the inability to apply skills in new settings) may result when knowledge presented in PD is “prepackaged”, “rigid”, “compartmentalized”, or “artificially neatened” (Spiro et al., 1987). ID PD covers simple processes that do not reflect the complexity of real-world practice (Bannan-Ritland, 2001; Jonassen & Hernandez-Serrano, 2002; Rowland et al., 1992). Therefore, there is a need to research how ID PD can better reflect real-world, complex, dynamic projects to facilitate transfer.

Best Practices in Project Management Professional Development

PM literature, like ID literature, suggests that PM PD should support the development of *thinking strategies* and *practice strategies*. Researchers argued that PMs need expert-like thinking strategies such as flexible decision making (Olsson, 2006), reflective practice (e.g., using PM models flexibly based on unique project characteristics) (L. Crawford et al., 2006; Shelley, 2015; Winter et al., 2006), and judgment (Cicmil et al., 2006; Project Management Institute, 2017). PMs also need practice strategies to respond to changes with action (ex. adapt methods, implement interventions, rework or remove plans) (Butt et al., 2016; Ivory & Alderman, 2005; Thomas & Mengel, 2008). The suggestions for PM PD go beyond traditional PM models (Aram & Noble, 1999; Jaafari, 2003; Winter et al., 2006) and static cases (Córdoba & Piki, 2012; Jennings, 2002; A. Martin, 2000) to engage novices in realistic, *messy* problems. These recommendations from the PM literature can inform the design of PD to prepare IDs for PM responsibilities.

Problem Summary

Designing and developing instruction is considered a project that requires IDs to think like experts (Ertmer et al., 2008); react to change (S. M. Kim, 2015; Rowland et al., 1992; Tripp, 1994); engage in flexible, iterative actions (Jonassen, 2008; S. M. Kim, 2015); and manage the triple constraint (Williams van Rooij, 2010; York & Ertmer, 2011). PM is therefore defined as a critical aspect of instructional designer competencies (Koszalka et al., 2012, 2013) and important for success in ID jobs (Willams van Rooij, 2011; Williams van Rooij, 2010, 2013). Research suggests that standard instructional methods, such as static cases, are not reflecting the *messiness* of managing projects. Preparing ID novices for PM responsibilities should thoughtfully and purposively engage learners in *thought and action* around *messy* PM problems to help them develop more expert-like thinking strategies (e.g., CF and judgment) and practice strategies (e.g., flexible and iterative planning actions).

In this dissertation study, *progressive* PM planning cases were developed to engage novice IDs in realistic scenarios that present complex and dynamic project experiences. The progressive cases involved developing project planning components that are interdependent (*complex*), change throughout the project planning phase (*dynamic)*, and require integration of theory to just-in-time practices (e.g., solving problems through *thought and action*).

Design Rationale

Engaging Learners in Dynamic Problems to Promote Cognitive Flexibility

Krems (1995) defined CF as "a person's ability to adjust his or her problem solving as task demands are modified" (p. 202). A majority of the variations of CBM may not fully support the development of CF because they do not include modification of task demands (e.g., emerging or changing constraints) or adjustment of problem solving (Krems, 1995). For example, *static cases* have been described as snap-shots or photographs of a problem (Hudspeth & Knirk, 1989; Zhu et al., 2010). Static cases may describe a scenario involving the triple constraint, but the constraints do not change during the learning process.

Multi-part cases are more complex than static cases because new information is presented during the learning process. Here, the problem scenario is presented in episodes, with each episode ending in a cliff-hanger (Wassermann, 1994). These cliff-hangers occur at critical moments when the protagonist needs to make a decision (Souid & Koszalka, 2018). At the end of each episode, learners discuss possible solutions. After the discussion, additional information presents the outcome of the previous episode and sets up a *new problem* to discuss (Barnes et al., 1994). Thus, the gradual disclosure of information during a multi-part case does not affect the problem constraints (Souid & Koszalka, 2018) and does not fully resemble dynamic real-world problems.

Progressive cases have constraints that emerge and change over time (Souid & Koszalka, 2015, 2018). Additional information presented during progressive cases *modify* the task to promote CF, as Krems (1995) suggested. Each type of case provides complex situations; however, not all of them provide dynamic situations that emerge and change with time, requiring the learners to adjust their thinking, plans, and solutions.

Engaging Learners in Action

Static and multi-part cases engage learners in *discussions* about the case problem (Barnes et al., 1994). In a progressive case, the learners are *making and implementing their own decisions* "based on *new information* that *affects the problem constraints or solution requirements"* (Souid & Koszalka, 2018). They require *expert-like thinking strategies* to decide how to respond to changing and emerging constraints and *practice strategies* to apply learned skills. Thus, progressive cases involve learners *in thought and action* under *dynamic* conditions.

Study Context

Although researchers argued that novice IDs need to be taught to deal with emerging constraints (Jonassen, 2008; S. M. Kim, 2015), they did not recommend specific teaching methods to do so. Similarly, Berggren and Söderlund (2008) argued that PM literature does not "offer much advice as to what educators should do besides the general recommendation that they should move away from" (p. 287) traditional PM models.

In this dissertation study, progressive cases, cases with changing constraints, were implemented in an online, graduate, PM course for ID students (Souid & Koszalka, 2018). Over the course of a semester, students worked in small groups to prepare a PM *plan* to address a problem presented in one of four cases. During the development of their PM plan, the instructor met with each team twice via a synchronous web-conference (*virtual session)*. During each virtual session, the instructor, playing the role of a client representative, introduced a *zinger*, a realistic and unexpected challenge. The zingers were modeled after common PM and design project challenges: increase in scope (addition of a multimedia element in the instruction) and shortened timeline (earlier delivery of the product).

Note, the instructor was the dissertation chair for the pilot study and this dissertation study. The researcher developed the zingers with the instructor and had no presence in the course and did not interact with the participants.

This dissertation study describes of how PM content can be taught online with a variety of synchronous (ex. virtual sessions) and asynchronous tools (ex. discussion boards), scaffolds (ex. worksheets, templates) (Luo et al., 2018), and learning activities (ex. progressive case, group project).

Significance of Study

In this dissertation study, the learning process during a *progressive case* was described by tracking participants' flexible thinking and PM judgment. Literature exists on the use of CBM or simulations that change over time in medicine (e.g., Benedict, 2010; Hong & Yu, 2017; Irby, 1994; Krems, 1995; Nendaz, Raetzo, Junod, & Vu, 2000), law (Boyne, 2012; Schrag, 1989), project management (Lee-kelley, 2018; A. Martin, 2000; Souid & Koszalka, 2018), and instructional design (Souid & Koszalka, 2015, 2018); however, the use of *progressive cases* has not been sufficiently used or studied, especially in ID and PM contexts.

Some researchers attempted to emulate emerging problem conditions with software simulations (e.g., Conradi et al., 2009; Josephsen & Butt, 2014; Martin, 2000; Zhu et al., 2010) or a group of actors (Boyne, 2012; Schrag, 1989). However, options using software or live actors are expensive, challenging to design, and difficult to execute (Conradi et al., 2009; Graham et al., 1992; Motowidlo et al., 1990). Others have implemented live cases with real clients or companies (Charlebois & Foti, 2017; Roth & Smith, 2009). While live cases provide the opportunity to apply emerging skills in the real world, research suggests that clients and companies are not fully committed to the learning process (Roth & Smith, 2009). In this dissertation study, students were exposed to emerging constraints with simple instructional materials and short exchanges with the instructor. During the virtual session, the instructor displayed the zinger by using a simple PowerPoint slide and shared that the client requested a project change. She answered any follow-up questions and then directed the students to discuss the new constraints, plan how they will respond, and fill out a worksheet built within the learning management system. Thus, this dissertation study was focused on informing the development of low-cost, low-barrier-for-entry, online progressive cases using tools available in most online courses (e.g., web conferencing, screen share, PowerPoint, and surveys).

Research Questions

The progressive case in this dissertation study was designed to bring about observable behaviors that demonstrate the students' learning. PM judgment is conceptualized as the *thoughts and actions* required to *protect or balance the triple constraint* (Maley, 2012; Project Management Institute, 2004) and *manage the interdependent parts* of PM plans (Project Management Institute, 2017). When responding to zingers, students may demonstrate PM judgment by drawing upon contingent resources; making compromises in time, cost, scope, or quality; and/ or revising their PM plans *consistently*, including going back to drafted parts.

CF is conceptualized as the *thoughts and actions* required to adjust problem solving when task demands change (Krems, 1995). Thinking flexibly about new problems (Spiro et al., 1992) involves considering multiple perspectives (Spiro et al., 1988) and seeking alternative solutions (M. M. Martin & Rubin, 1995, p. 623). CF was measured with a validated instrument (M. M. Martin & Rubin, 1995).

The following research questions were investigated:

1. How do teams respond to unexpected changes during PM planning tasks?
2. Are participants exhibiting CF during PM planning tasks?
3. How does implementing zingers in a progressive case affect CF in participants over a semester?
4. Are participants exhibiting PM judgment during PM planning tasks?
5. How does implementing zingers in a progressive case affect PM judgment over a semester?

Definitions of Key Terms

1. **Project:** “Defined as having the following characteristics: complex and numerous activities, unique—a one-time set of events, finite—with a begin and end date, limited resources and budget, many people involved, usually across several functional areas in the organizations, sequenced activities, goal-oriented, end product or service must result” (Weiss & Wysocki, 1992, p. 3).
2. **Project management (PM):** A “method and set of techniques based on the accepted principles of management used for planning, estimating and controlling work activities to reach a desired end result on time, within budget, and according to specification” (Weiss & Wysocki, 1992, p. 5).
3. **Project management (PM) plan:** “The document that describes how the project will be executed, monitored and controlled, and closed” (Project Management Institute, 2017, p. 716)**.**
4. **Triple constraint:** Tension between conflicting demands in constraints such as time, money, and quality (Maley, 2012; Project Management Institute, 2004).
5. **Contingency**: “Provision made within the project planning stages to allow for unforeseen circumstances; usually built into the budget or schedule” (Harrin, 2013).
6. **Instructional design (ID):** “Encompasses the analysis of learning and performance problems, and the design, development, implementation, evaluation and management of instructional and non-instructional processes and resources intended to improve learning and performance in a variety of settings, particularly educational institutions and the workplace” (Reiser, 2001, p. 53).

7. **Judgment:** "Inferences or evaluations that go beyond obvious statements of fact, data, or the conventions of a discipline" (Otway & von Winterfeldt, 1992, p. 84). When making decisions in uncertain environments, intuition, rather than logic, is needed (Stacey, 1996).
8. **PM judgment:** PM standards discuss the importance of expert judgment (Project Management Institute, 2017) because PM activities are uncertain and have many possible solutions. Thus, they require more than the adherence to simple logic rules (Stacey, 1996). However, there is not a consistent definition of (expert) judgment in PM literature or models (Szwed, 2016). In this dissertation study, PM judgment is conceptualized as the decision making required to protect and balance the triple constraint and manage the interdependent parts of PM plans.
9. **Interaction:** There are three types of interaction in online courses: student-content, student-instructor, and student-student (Moore, 1989). In this dissertation study, interaction describes action (Bernard et al., 2009, p. 1247) that occurs during a learning experience. Specifically, this includes the creation of any tangible representation of a student's learning (ex. PM plan). Abrami and colleagues (2011) suggested that student-content interaction may include activities such as "completing assignments and working on projects" (p. 86).
10. **Engagement:** "Interaction and engagement are closely related and even used interchangeably" (F. Martin & Bolliger, 2018). In this dissertation study, engagement describes thinking processes that occur during a learning experience (ex. problem solving, cognitive flexibility). This is described as student-content interaction: "intellectually interacting with content that results in changes in the learner's

understanding, the learner's perspective, or the cognitive structures of the learner's mind" (Moore, 1989, p. 2).

11. **Case:** "Objects of instruction [that]…present new information, concepts, and theories" (Ertmer & Russell, 1995, p. 24); used within the case-based method.
12. **Case-based method (CBM):** "An umbrella term for all methods that utilize cases extensively for pedagogical purposes" including terms such as "case-based instruction, case-based approach, case-based reasoning, and case-based learning" (Luo, 2015, p. 5).
    a. "A teaching method which requires students to actively participate in real or hypothetical problem situations, reflecting the kind of experiences naturally encountered in the discipline under study" (Ertmer & Russell, 1995, p. 24).
13. **Static case:** A case with constraints that do not emerge or change during the learning process.
14. **Progressive case:** A case with constraints that emerge or change during the learning process. Progressive cases engage learners in *thought and action.*
15. **Zinger:** Realistic and unexpected challenges presented during a progressive case, resulting in a change in problem constraints.
16. **Cognitive flexibility (CF):** CF (e.g., flexible thinking) is conceptualized as (Souid & Koszalka, 2018):
    a. Thinking about knowledge from different perspectives (Spiro et al., 1988);
    b. Making interconnections between content and cases (Spiro et al., 1988);
    c. Considering alternatives (M. M. Martin & Rubin, 1995, p. 623); and
    d. Adjusting one's problem solving as the task changes (Krems, 1995).

17. **Case Study Research Method (CSRM):** An "empirical method that investigates a contemporary phenomenon ("the case") in depth and within its real world context" (Yin, 2018, p. 15).
18. **Time-series analysis:** A specific analytic strategy within CSRM. Chronological sequences can be used to "investigate presumed causal relationships—because the basic sequence of a cause and its effect cannot be temporally inverted" (Yin, 2018, pp. 184–185).
19. **Novice:** Expertise requires "a minimum of ten years of intense training" (Ericsson et al., 2007, p. 118). The term, novice, is used to describe individuals with less than ten years of experience. In this dissertation study, the learners, students, and participants were beginning to develop PM knowledge and skills. Thus, they were on the lower end of the novice category.
20. **Learners:** People who are engaged in PD.
21. **Students:** Individuals who are in the PM course being investigated in this dissertation study.
22. **Participants:** Students who provided IRB consent to participate in this dissertation study.

Summary

Almost 90 years ago, Dewing stated that business professionals need to "meet in action the problems arising out of new situations of an ever-changing environment" (as cited in Barnes, Christensen, & Hansen, 1994, p. 41). This statement reflects a current need in ID PD and PM PD. Since ID and PM projects are dynamic, novices need to develop flexible thinking (CF) and PM judgment to choose how to actively respond to unexpected changes. CBM has been used in various disciplines to train novices to think like experts. However, some CBM variations may be better than others to support the development CF and prepare novices to respond to change in projects.

In this dissertation study, *progressive cases*, cases with emerging or changing constraints, were integrated into an online, graduate-level, PM course. The progressive case included *zingers,* realistic and unexpected challenges, that interrupted students' PM planning activities. These zingers helped simulate the *messiness* of real-world practice and required students to adjust their thinking, judgments, and PM plans.

This dissertation study aims to inform the design of instruction to prepare novices to respond to unexpected events and solve messy problems. It *describes* the learning process during the *progressive case* by tracking participants' flexible thinking (cognitive flexibility [CF]) and PM judgment in *thought* and *action dimensions* over a semester.

In the next chapter, the connections between ID and PM will be presented. PM PD will be discussed as a model for training IDs to perform PM responsibilities. CBM will be presented in more detail, including an overview of the variations found in the literature across disciplines and how the design of CBM may impact the development of CF. The context of the dissertation study will be introduced, detailing the design of the course and the progressive cases. Best practices and common misconceptions and errors around responding to project changes will be outlined to provide research support for this dissertation study's data analysis framework.

Chapter 2: Literature Review

Introduction

Professional development (PD) should prepare instructional design (ID) novices for project management (PM) responsibilities by thoughtfully and purposively engaging learners in *thought and action* around *messy* PM problems. To simulate real-world PM practice, *zingers*, or realistic and unexpected challenges, were introduced in different parts of the *progressive case*, interrupting the PM work process and prompting reactions involving flexible thinking and judgment. Working on *complex* and *dynamic* project problems may help novices develop more expert-like *thinking strategies* (e.g., flexible thinking and judgment) and *practice strategies* (e.g., flexible and iterative planning actions). This dissertation study employed the case study research method (CSRM) to describe the learning process during a progressive case by tracking flexible thinking (cognitive flexibility, CF) and PM judgment in *thought and action* dimensions over a semester. It seeks to inform the design of PD, particularly the design of instruction utilizing the case-based method (CBM), to better prepare novices to respond to unexpected events and solve messy problems.

This chapter reviews relevant literature on instructional design (ID), project management (PM), cognitive flexibility (CF), and the case-based method (CBM). The discussion begins with research on the transfer of learning from professional development (PD) to real-world practice. Then, the relationship between ID and PM will be presented, supported by research on the common *messy* characteristics of design and PM projects. PM literature will serve as a model to inform how to train novice IDs for PM responsibilities. This chapter will discuss literature on PM models; unexpected events, changes, and flexibility in PM; and recommendations for PM PD. CF will be discussed as it relates to thoughts and actions required in dynamic project situations. A discussion of CBM follows, including a comparison of case types and a proposal for the use of progressive cases to promote CF. An introduction to the study context, including details on the design of the course and the progressive cases follows. The chapter ends with an overview of best practices and common misconceptions/ errors around responding to project changes. This will inform the data analysis framework outlined in Chapter 3.

Transfer of Learning

Solving a new problem (S. M. Williams, 1992) or working within a new context (Archer et al., 2014) requires the *transfer* of learned skills. To foster transfer of learning, teaching methods need to "enhance the ability of students to make connections and…[put] learning into practice" (Macaulay, 2000). Methods such as problem-based learning, simulations, and CBM can support transfer (Macaulay, 2000). The goal of this dissertation study was to improve transfer by providing instruction that is complex and dynamic, mirroring the *messiness* of real-world projects (Macaulay, 2000).

Types of Transfer

Kennedy (1990) described two goals for PD with different approaches to transfer. The first goal (referred to here as *knowledge-focused*) is to provide knowledge about all of the possible situations learners may encounter in practice. The perspective assumes that problems are predictable, generalizable, and categorical, allowing knowledge to be transferred to new situations based on its type (Kennedy, 1990).

The second goal (referred to here as *thought-focused*) is to "prepare students to think on their feet…analyzing and interpreting new situations until they are sufficiently flexible and adaptable to accommodate the variety of situations they are likely to encounter" (Kennedy, 1990, p. 813). This perspective prepares learners to adapt techniques and create their own solutions

(Kennedy, 1990). In an ID context, Yanchar and Gabbitas (2011) advocated for critical flexibility where the ID adjusts to the "unfolding nature of one's design experience" (p. 391), rather than adhering to ID models. Also in the ID context, the "creative" view of design calls for generating solutions to unique problems (Rowland et al., 1994). PM researchers made similar recommendations (Thomas & Mengel, 2008; Winter et al., 2006).

Thought-focused transfer involves the development of flexible thinking, allowing one to adapt to various contexts and situations. While at first glance, it may seem that thought-focused transfer is more appropriate for training professionals for dynamic problems, a balance of the two goals is necessary (Kennedy, 1990).

Lack of Transfer from Professional Development to Practice

Transfer problems (e.g. "the inability to apply knowledge to new cases" (Spiro et al., 1992, p. 2) may be due to a mismatch between the content and teaching methods in PD and the required knowledge and skills for real-world practice (Ashleigh et al., 2012; Jonassen & Hernandez-Serrano, 2002; Macaulay, 2000). Transfer problems may result when problems presented in PD are "prepackaged" and "rigid" (not adapted for unique contexts), "compartmentalized" (interconnected knowledge is presented in isolated parts), "artificially neatened" (simplified knowledge), and assumed to be "regular" or "consistent" (Spiro et al., 1987).

Research supports that ID PD (Bannan-Ritland, 2001; Jonassen & Hernandez-Serrano, 2002; Rowland et al., 1992) and PM PD (Aram & Noble, 1999; Ivory & Alderman, 2005; Ramazani & Jergeas, 2015; Thomas & Mengel, 2008) do not reflect the complex, dynamic nature of real-world projects. For example, novice IDs (with less than two years of experience) had difficulty considering the business constraints of a work problem because their past experiences were in an academic setting where "projects were judged based on academic standards rather than business practices and rules" (Fortney & Yamagata-Lynch, 2013, p. 100).

Instructional Design and Project Management

"The ability to balance a variety of potentially competing interests, goals, and the needs of a large amount of learners exemplify the importance of instructional designers having expertise in managing, multitasking, and directing a complex ID project" (Sugar & Luterbach, 2016, p. 304).

Designing instruction is a project (Table 1). This section will start with a discussion of the relationship between ID and PM followed by research on (project) management in ID practice. The section ends with a discussion of how novice IDs are inadequately prepared for PM responsibilities.

Project Management in Instructional Design Practice

ID is defined as "the analysis of learning and performance problems, and the design, development, implementation, evaluation and management of instructional and non-instructional processes and resources intended to improve learning and performance in a variety of settings, particularly educational institutions and the workplace" (Reiser, 2001, p. 53). Thus, ID practice involves solving design problems through action (e.g., beyond thinking and planning) with a range of activities including execution and management.

Design projects share many of the characteristics of PM projects (Table 1). Reiser's (2001) definition of ID outlined a systematic process that is similar to the phases of PM. Weiss and Wysocki (1992) described PM as consisting of the following phases: "define, plan, organize, control, and close" (p. 5). Similarly, the PMBOK ® Guide (*PMBOK (R) Guide and Standards*, 2018) conceptualized projects as having the following phases: starting the project, organizing and preparing, carrying out the work, and ending the project. Thus, both ID and PM include beginning and end phases, with a progression from planning to delivery.

Table 1

Characteristics of Project Management (PM) Projects and Design Projects

PM Projects (Weiss & Wysocki, 1992, p. 3)	Design Projects
Complex and numerous activities	Multiple interdependent tasks required in analysis, design, development, and management phases of ID (Reiser, 2001)
Unique—a one-time set of events	May undergo iterations/ revisions based on end-user feedback (C. Crawford, 2004); however, products are generally implemented as a unique event.
Finite—with a begin and end date	Delivered to learners on a specified date (Williams van Rooij, 2010, p. 855)
Limited resources and budget	Time, budget, quality constraints (Williams van Rooij, 2010; York & Ertmer, 2011)
Many people involved, usually across several functional areas in the organizations	Requires successful interaction with multiple stakeholders (Fortney & Yamagata-Lynch, 2013; S. M. Kim, 2015; Sugar & Luterbach, 2016; Williams van Rooij, 2013; York & Ertmer, 2011)
Sequenced activities	ID models theorize practice into sequenced activities (ex. ADDIE) (Rowland et al., 1994).
Goal-oriented	Design problems are “acting on goals to produce [an] artifact” (Jonassen, 2000, p. 75).
End product or service must result	Instructional and non-instructional solutions (Reiser, 2001).

However, there are notable differences between ID and PM:

a) *PM emphasizes different activities, such as control of the triple constraint.* Weiss and Wysocki (1992) conceptualized PM as primarily involving delivery of a project through the management of the triple constraint (Maley, 2012; Project Management Institute, 2004). When there are increased demands for one of the constraints, adjustments need to be made in the other constraints (Maley, 2012). IDs also need to design and manage within the triple constraint (Williams van Rooij, 2010; York & Ertmer, 2011); however, it is only part of what they do.

b) *IDs need to manage projects, but PMs do not need to practice ID.* "Project management is embedded in the successful execution of the various phases and stages of the instructional design process" (Williams van Rooij, 2010, p. 858). Thus, PM is an essential part of ID activities. Conversely, the design and evaluation of products or services are not parts of PM. Researchers questioned whether PM should be expanded to include front-end specification development (L. Crawford et al., 2006; P. Morris, 2013) and impact beyond efficiency (P. Morris, 2013). These proposed expansions are part of ID practice and are currently outside of PM practice.

Importance of Management in Instructional Design

The International Board of Standards for Training, Performance and Instruction (ibstpi) outlined instructional designer competencies in the domains of professional foundations, planning and analysis, design and development, evaluation and implementation, and management (Koszalka et al., 2012). Thus, ID and PM competencies overlap (Willams van Rooij, 2011) because IDs need PM skills in their jobs (Williams van Rooij, 2010, 2013).

Practicing IDs confirmed that management is essential for ID practice. Sugar and Luterbach (2016) asked practicing IDs to describe effective and extraordinary work incidents. Effective incidents involved elements of ID procedural models (ex. "creating instructional products") and soft skills (ex. "collaborating with stakeholders") (Sugar & Luterbach, 2016, p. 287). Extraordinary incidents included managing complex projects (Sugar & Luterbach, 2016, p. 287).

York and Ertmer (2011) surveyed practicing IDs about essential activities in their jobs and found that they aligned with skills outlined in ibstpi competencies, including communication and management. In particular, IDs need to communicate effectively to manage constraints that are sometimes understated or vague during the planning process. "Negotiate the scope of the project with the client and create a statement of work upfront...Sometimes the client will not tell you all there is to know about a problem" (York & Ertmer, 2011, p. 848). Similarly, Kim (2015) argued that ID practice can be conceptualized as “negotiation between an instructional designer and under-stated constraints that multiple stakeholders convey” (p. 26).

Project Management Training in Instructional Design Programs

“Two gaps are apparent in our knowledge regarding the preparation of instructional designers: one involves the basis for that preparation—understanding how designers actual [sic] work—and the other involves development and validation of methods for teaching the complex performance that is design” (Tracey & Boling, 2014, p. 658).

PM is taught in less than a quarter of graduate-level ID programs, resulting in a gap between PD and real-world practice (Williams van Rooij, 2010). For example, Larson (2005) found that IDs didn’t feel prepared in the area of “availability of project resources for work assignments” (p. 29) and were prepared but experienced issues (transfer problems) around trade-offs within the triple constraint. This may be due to lack of PM training in ID PD (Williams van Rooij, 2010) or *neatened* PD experiences (Bannan-Ritland, 2001; Jonassen & Hernandez-Serrano, 2002; Rowland et al., 1992).

Real-World Projects are Complex, Uncertain, Dynamic, and Non-linear

Both PM projects and design projects are complex, uncertain, dynamic, and non-linear (Geraldi et al., 2011) in other words real-world projects are *messy* (Table 2).

Complexity in projects is related to how difficult it is to understand a system due to “multiple structural elements interacting and changing as they progress” (Whitty & Maylor, 2009, p. 305). Complex projects have many parts and the parts are *interdependent*, meaning a change in one part may cause a ripple effect (Cooper & Reichelt, 2004). For example, a reduction in a project's budget may require reducing the project's scope, such as delivering the product with fewer multimedia elements. This suggests that fewer computer programmers need to be hired, resulting in a reduction in cost, and so on.

Table 2

Supporting Research on the Characteristics of PM and Design Projects

Project Characteristic	Supporting Research of PM Project Characteristic	Supporting Research of Design Project Characteristic
Complex Multiple parts, interdependent/ interacting parts (Whitty & Maylor, 2009)	Five dimensions of complexity (Geraldi et al., 2011); model of complexity based on interaction and change between elements (Whitty & Maylor, 2009); variables influence one another (Chia, 1997; Ivory & Alderman, 2005); complexity attributes to success or failure of a project (Bjorvatn & Wald, 2018)	Parts are connected and contingent (Goel & Pirolli, 1992), ID is complex, ill-structured (Ertmer & Stepich, 2005; Jonassen, 2008), IDs need to manage complex projects (Sugar & Luterbach, 2016)
Uncertain Lack of information or agreement, ambiguity (Geraldi et al., 2011)	Complexity dimension of projects (Geraldi et al., 2011), uncertainty is related to the level of cooperation between the PM and customer (Gil & Tether, 2011); all projects have uncertainty (Geraldi et al., 2010; Hallgren & Maaninen-Olsson, 2005; Whitty & Maylor, 2009)	Lack of information (Goel & Pirolli, 1992; York & Ertmer, 2011), missing constraints (Jonassen, 2000, 2008), experts are better at dealing with ambiguity (Fortney & Yamagata-Lynch, 2013), negotiate with stakeholders for agreement (S. M. Kim, 2015)
Dynamic Change in projects (Geraldi et al., 2011) (e.g., changing or emerging constraints, unexpected events)	Complexity dimension of projects (Geraldi et al., 2011), 7 types of unexpected events (Geraldi et al., 2010); model of risk, change, and deviation (Hallgren & Maaninen-Olsson, 2005); use constant interventions to deal with emerging factors (Ivory & Alderman, 2005); all projects have unexpected events (Whitty & Maylor, 2009) and change (Winter et al., 2006)	Constraints emerge (Jonassen, 2008; S. M. Kim, 2015), IDs need to react to change (Tripp, 1994), judgments shaped by requests and changes (Gray et al., 2015)
Non-linear Iterative, non-sequential, flexible steps	Changes may require reworking (Butt et al., 2016; Geraldi et al., 2011), constant adjustments (Ivory & Alderman, 2005), iterative steps (P. Morris, 2013), flexible decision processes (Olsson, 2006)	Iterative problem solving (Goel & Pirolli, 1992), design cycles (Jonassen, 2008), iterative planning (S. M. Kim, 2015), continuous judgments/ adjustments (Gray et al., 2015), experts iterative thinking (Perez & Emery, 2008), experts develop alternatives and remain flexible, delaying commitment (Rowland, 1992); practice can be "unordered" (Tripp, 1994), critical flexibility to adapt models, open to other perspectives (Yanchar & Gabbitas, 2011)

Uncertainty is associated with lack of information or agreement between stakeholders, and ambiguity (Geraldi et al., 2011). For example, clients may not provide all of the information needed for a project (York & Ertmer, 2011) or the PM and client may have different priorities (Gil & Tether, 2011; Olsson, 2006).

Dynamics "refers to changes in projects" (Geraldi et al., 2011, p. 978), for example, the budget may be reduced (S. M. Kim, 2015) or laws and standards may change (Butt et al., 2016; Cooper & Reichelt, 2004) (ex. new building codes may affect a construction project).

Non-linearity is related to uncertainty and emergence (Geraldi et al., 2011); when new information comes to light or unexpected events occur, a PM needs to stop and revise their plans, including going back to adjust completed components (Butt et al., 2016; Cooper & Reichelt, 2004). Thus, *non-linear* projects are iterative (Guldemond et al., 2008; Rowland et al., 1994) and non-sequential, involving flexible steps (Jonassen, 2008) to accommodate changes.

Project Management Models

Background on Project Management Models

The Project Management Institute (PMI) develops widely accepted global PM standards ("PMBOK ® Guide and Standards," 2018) and produces editions of the PMBOK ® Guide (Project Management Body of Knowledge ® Guide) every four years, outlining traditional and innovative "good practice" (Project Management Institute, 2017, p. 2). The term *PM model* will be used to refer to standards, bodies of knowledge, and practices prescribed by PMI.

The PMBOK ® Guide is divided into Project Management Knowledge Areas that describe processes, tools, and techniques required for practice. Knowledge Areas that are highly related to this dissertation study are:

1. **Project Scope Management:** PMs are expected to manage the scope of the project to ensure that all required work is completed. Scope is defined as "the sum of the *products, services,* and *results* to be provided as a project" (Project Management Institute, 2004).
2. **Project Schedule (Time) Management:** PMs are expected to manage schedules to complete the project on time (Project Management Institute, 2004, 2017).
3. **Project Risk Management:** PMs are expected to monitor risk, and plan (Project Management Institute, 2004) and implement responses (Project Management Institute, 2017).

Limitations of Traditional Project Management Models

In this section, traditional PM models (PMBOK® editions published before 2017) will be compared to the 6th edition of the PMBOK ® Guide (published in 2017). It was assumed that traditional PM models described what was required for practice; however, research suggests that performance against standards does not guarantee effectiveness at work (L. Crawford, 2005; Thomas & Mengel, 2008). Instead, according to senior managers, effective PMs work on "projects that have high ambiguity" (L. Crawford, 2005, p. 15)—in other words, effectiveness goes beyond traditional PM models. Dealing with the *messiness* of projects is more appreciated at the workplace.

Traditional PM models underemphasized the dynamic and non-linear nature of projects. Projects were conceptualized as being well-defined (L. Crawford et al., 2006), linear (L. Crawford et al., 2006, p. 724; Thomas & Mengel, 2008; Winter et al., 2006), stable (Aram & Noble, 1999), and predictable (Aram & Noble, 1999). In these traditional models, PM was considered execution-focused (P. Morris, 2013; Svejvig & Andersen, 2015), involving "a linear sequence of tasks" (L. Crawford et al., 2006, p. 724) to meet fixed and determined objectives

(Andersen, 2016). However, "this process basis masks, critically, the characteristics and challenges of the different stages of the project development life cycle" (P. Morris, 2013, p. 8).

When projects were assumed to be less dynamic and more linear, initial planning was emphasized as a way to identify and control risks (Geraldi et al., 2010). However, researchers argued that initial planning did not remove the uncertain and dynamic characteristics of projects (Geraldi et al., 2010; Matta & Ashkenas, 2003). The complexity and uncertainty of projects "are beyond long-term contemplation and, thus, defy the classical management approach of orderly planning and control" (Jaafari, 2003, p. 47).

Newer Project Management Models

The 6th edition of PMBOK ® Guide addressed some of the limitations of traditional PM models. First, researchers critiqued that traditional PM models conceptualized projects as being linear (L. Crawford et al., 2006; Thomas & Mengel, 2008; Winter et al., 2006). Newer PM models are less linear stating that “Phases may be sequential, iterative or overlapping” (Project Management Institute, 2017, p. 19). Also, in the 6th edition of the PMBOK ® Guide, PMs have more flexibility. PMs are encouraged to *tailor* (adapt, adjust) PM models for unique situations and projects (Project Management Institute, 2017). PM processes may be used at “predefined points in the project…periodically as needed…[or] continuously throughout the project” (PMBOK (R) Guide, 2017, p. 22).

Researchers critiqued that traditional PM models focused too much on initial planning (Geraldi et al., 2010). The 6th edition added *risk response implementation* (Project Management Institute, 2017), calling for PMs to take *action* when unexpected changes and events occur in a project. Furthermore, this edition deemphasized initial planning by validating a variety of development life cycles (Project Management Institute, 2017).

The type of development life cycle affects how scope, time, and cost are determined and managed; how the product is developed; and how change and risk are addressed (Project Management Institute, 2017). The categories of development life cycles range from *predictive* (stable) projects to *agile* (more adaptive and iterative) approaches (Table 3). In predictive projects, scope, schedule, and cost are determined early on and changes are constrained (Project Management Institute, 2017). Agile projects are more flexible; constraints are estimated and modified throughout the project process (Project Management Institute, 2017).

Table 3

Development Life Cycles

	Predictive Projects	Agile Projects
Requirements	Define at the beginning of the project	Elaborate throughout the project
Delivery	Deliver final product at the end	Deliver product in increments
Change	Constrain change	Incorporate change during project work
Control	Plan for all known elements	Elaborate plans as constraints change

Note. Based on (Project Management Institute, 2017, p. 666)

Risk, Change, and Deviation

The PMBOK ® Guide (Project Management Institute, 2017) defined risk and change as follows:

- Risk is “an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives” (p. 720).
- Change is “a modification to any formally controlled deliverable, project management plan component, or project document” (p. 700).

Risk is the *cause*, and change is the *effect*. Risks require changes in the PM plan and product.

Hallgren and Maaininen-Olsson (2005) provided an alternate conceptualization of risk and change: *risks and changes are causes*. In this model, risks can be anticipated or predicted, allowing for more proactive management. Whereas, changes require reactive management (Hallgren & Maaninen-Olsson, 2005)—responding by taking action.

For consistency in this dissertation study, the terms *unexpected event or change* will refer to causes and the terms *response, reaction, revision, edit, or adjustment* will refer to effects.

Impact of Unexpected Events and Changes

"Projects are inherently uncertain and face unexpected events" (Geraldi et al., 2010, p. 547). Geraldi and colleagues (2010) described seven categories of unexpected events: "*technical issues, sponsor withdrawing support, external events, resource change or constraint, human behaviour and project scope*" (p. 552). These events may be known-unknowns or unknown-unknowns. Known-unknowns are events that PMs "have identified as possibly existing, but do not know whether they will take place or not" (Geraldi et al., 2010, p. 553). Thus, not all unexpected events are complete surprises. For example, an ID managing a design project can reasonably suspect that the client *may* request changes, but they do not know what changes will occur.

Changes, including unexpected events, have direct and indirect impacts on a project (Butt et al., 2016). Direct impacts include adding or deleting of work, re-working, rescheduling, adding or reducing project requirements, and demands for more product features (Butt et al., 2016). Indirect impacts include alterations to critical paths, increased scope risks, and stakeholder relationship (Butt et al., 2016).

Strategies for Reaction to Change

According to the PMBOK ® Guide, projects need to have *project resilience*: contingencies and flexibility to deal with emerging changes (Project Management Institute, 2017). Contingencies and flexibility can be built into projects during initial PM planning. For example, a PM plan can include time and budget contingencies (Harrin, 2013): cushions in the schedules and budget that can be used when there are deviations from the plan. PMs can build a flexible project work schedule and start the project with additional team members in anticipation of project changes (Guldemond et al., 2008). Contingency and flexibility protect the project and the triple constraint, reducing the potential negative impact of a change.

The PMBOK ® Guide provided three strategies for dealing with threats (e.g., risks that negatively impact a project) (Project Management Institute, 2017, p. 443).

- *Avoid*: "Eliminate the threat or protect the project from its impact"
- *Mitigate*: "Reduce the probability of occurrence and/or impact of the threat"
- *Accept*: "Acknowledge the existence of a threat, but no proactive action is taken". Includes using contingent resources.

Some research has addressed how to react to change; however, there is a need for more research (Geraldi et al., 2010). Geraldi and colleagues (2010) proposed that successful responses to unexpected events are dependent on characteristics of the organization, group, and individual. To successfully respond to an unexpected event, PMs need to have authority and freedom to act, have buy-in from stakeholders, and be competent. Butt and colleagues (2016) proposed a model for change management including the following steps: "identify change....evaluate and propose change…approve change…implement change…review change" (p. 1581). Gillard and Price (2005) suggested that effective PMs are proactive and do not wait for "events to unfold" (p. 49). A proactive PM is "cognizant of environmental influences and makes decisions which shape the environmental impact rather than decisions which are merely reactionary" this includes introducing change themselves and preventing "mishaps" (Gillard & Price, 2005, p. 51).

Project Flexibility

Part of project resilience is building flexibility in project processes (Project Management Institute, 2017). PM models advocate for *progressive elaboration:* “developing in steps, and continuing by increments” (Project Management Institute, 2004). This entails developing broad plans early in the project and making them more detailed “as the project team develops a better and more complete understanding of the objectives and deliverables” (Project Management Institute, 2004). The strategy proposes a way to deal with uncertainty due to lack of information.

Olsson (2006) argued that projects can be flexible in *decision process* and *product*. Strategies for flexibility in decision making include *late locking* (iterative front-end planning), *continuous step-by-step locking* (incremental decision making), and *contingency planning* (alternative plans) (Olsson, 2006). For example, an ID may decide to draft a rough PM plan and make revisions when needed; delay making some decisions until more is known about the project; or develop a Plan A, B, C, and etc. Product flexibility is "achieved when the final product of the project is prepared for alternative use" (Olsson, 2006, p. 67). For example, an ID can design a template that will facilitate the development of future products or develop instruction that can be used in multiple contexts.

Flexibility, particularly product flexibility, is important to the client (Gil & Tether, 2011; Olsson, 2006). "Because customers’ needs evolve over time, they understandably want process flexibility to postpone design decisions and request late changes” (Gil & Tether, 2011, p. 415). Clients want the flexibility to change the product to make it *more effective*; however, this usually makes the project *less efficient* because the changes require more time and money (Gil & Tether, 2011).

Project Management Programs

Model of Project Management Development towards Expertise

Researchers proposed a model of PM development that includes three levels: apprenticeship ("novices and advanced beginners"), journeyman ("competent and proficient performers"), and master ("emotionally and spiritually intelligent expert") (Thomas et al., 2004). Higher levels of PM development are associated with being intuitive, responsive (rather than reactive), and adaptive (Thomas et al., 2004). Master-level PMs have "the ability to thrive on change…adapt to change and develop new approaches on the fly" (Thomas & Mengel, 2008, p. 309).

Different PD methods are recommended for each development level. PD for apprentice-level PMs includes expert coaching and formal education on PM fundamentals (Thomas et al., 2004). Development of journeyman-level PMs requires experience and training in advanced topics (Thomas et al., 2004).

Recommendations for Project Management Professional Development

PM practice is messier than how it is represented in PM models; however, "the universal PM best practice prescriptions and professional standards… remain at the core of most PM courses" (Cicmil & Gaggiotti, 2018, p. 209). Egginton (2012) found that PM PD helped learners understand the language of PM and apply fundamental knowledge and skills; however, there were transfer problems due to workplace characteristics. As PMs gained more work experience, the utility of taught PM models decreased because of their limitations in real-world environments (Egginton, 2012). Researchers proposed ways to develop PD that reflect the *messiness* of real-world projects (L. Crawford et al., 2006; Winter et al., 2006).

Preparation for Project Uncertainty

Traditional PM PD assumes PMs are working on projects with high levels of certainty and agreement (Aram & Noble, 1999). However, this is not always the case—projects will always have uncertain elements (e.g., Geraldi et al., 2010; Ramazani & Jergeas, 2015). Aram and Noble (1999) argued that different teaching methods are appropriate for each level of certainty and agreement (Table 4); therefore, deficiencies in PM PD may be due to the use of teacher-centered teaching methods that don't challenge novices to think through uncertain problems.

Table 4

Certainty, Agreement, Decision-making Modes, and Teaching Methods

Level of Certainty	Level of Agreement	Decision-making Modes (Stacey, 1996, p. 47)	Level of Knowledge (Aram & Noble, 1999, p. 326)	Teaching Methods (Aram & Noble, 1999, p. 326)
High	High	Rationale decision making, monitoring	Knowledge and facts	Lectures and demonstrations
Moderate	High	Judgment and logic	Understanding	Seminars and tutorials
Moderate	Moderate	Brainstorming and intuition	Practice	Workshops
Moderate	Low	"Garbage-can decision-making"	Practice	Workplace experience
None	None	Avoidance and disintegration	"No learning is possible"	None

Recently, "Responsible Project Management Education" prescribed PM PD that accounts for the "inevitable uncertainty and ambiguity of project goals…[and] the resulting contingent nature of project planning and control" (Cicmil & Gaggiotti, 2018, p. 212). The model suggests that PM PD should teach practical wisdom, and involve experiential reflective learning (Cicmil & Gaggiotti, 2018, p. 208).

Recommendations for Dynamic Projects

There is an "ever-changing flux of events" (Winter et al., 2006, p. 644) in projects. These events may be emergent and unpredictable (Cicmil & Gaggiotti, 2018). When dealing with emerging conditions in complex situations, masters act and react without engaging in time consuming analysis (Thomas & Mengel, 2008). PM PD should try to prepare novices to emulate the practice of masters (Souid & Koszalka, 2018); this can be done by sharing masters' tacit knowledge and heuristics (Thomas & Mengel, 2008), and practical wisdom (Cicmil & Gaggiotti, 2018) which are not typically captured in PM models.

"Unforeseen events are inevitable to some degree in almost all projects" (Whitty & Maylor, 2009, p. 306). When unpredictable events occur, novice PMs need to know how to "act in the middle of complex and chaotic situations by choosing the right technique at the right time" (Ramazani & Jergeas, 2015, p. 44). Taking it a step further, novices need to "diagnose situations, adopt appropriate tools and techniques, adapt the tools and techniques as necessary, and to learn continuously" (Thomas & Mengel, 2008, p. 311). Thus, novices need to know how to use PM techniques, and how to adapt techniques to unique and complex situations (Souid & Koszalka, 2018). Therefore, PM PD needs to encourage questioning (Cicmil & Gaggiotti, 2018; Thomas & Mengel, 2008) and reflecting about (e.g., L. Crawford et al., 2006; Shelley, 2015) PM models. Through this type of thinking, novices will learn how to adapt the methods prescribed in PM models.

Preparation for Non-linear Practice

Ivory and Alderman (2005) argued project failure is related to the non-linearity of events that are difficult to predict, such as "unanticipated cost and time overruns and even suboptimal design" (p. 6). Thus, PMs need implement constant interventions to control changes and complexities in a project (Ivory & Alderman, 2005).

Summary

PM literature provides recommendations for preparing novice PMs to work on *messy,* real-world projects (Table 5). Novice PMs need to learn through experience and sense-making

(L. Crawford et al., 2006), with the teacher taking on a supportive rather than directive role (Aram & Noble, 1999). Researchers advocated for student-centered learning approaches such as case studies (Córdoba & Piki, 2012) and simulations (Ramazani & Jergeas, 2015).

Table 5

Recommendations for Project Management Professional Development

Recommendations	Supporting Literature
Develop PMs who can adapt and be flexible	(Jaafari, 2003; Ramazani & Jergeas, 2015; Thomas & Mengel, 2008; Winter et al., 2006)
Engage novice PMs in reflection	(Cicmil & Gaggiotti, 2018; L. Crawford et al., 2006; Shelley, 2015; Winter et al., 2006)
Engage novice PMs in questioning PM models	(Cicmil & Gaggiotti, 2018; Thomas & Mengel, 2008)
Share tacit knowledge, heuristics, and practical wisdom	(Cicmil & Gaggiotti, 2018; Thomas & Mengel, 2008)
Use student-centered approaches	(Aram & Noble, 1999)
Use cases and simulations	(Córdoba & Piki, 2012; Ramazani & Jergeas, 2015)

Cognitive Flexibility Theory

Reductive bias, oversimplification of content into a single mental representation or generalization, and *transfer problems* hinder the development of expertise (Spiro et al., 1988). Principles of cognitive flexibility theory (CFT) address these problems by providing the opportunity for more complex thinking about content (Souid & Koszalka, 2018).

"A central claim of cognitive flexibility theory is that revisiting the same material at different times, in rearranged contexts, for different purposes, and from different perspectives is essential for attaining the goals of advanced knowledge acquisition (mastery of complexity in understanding and preparation for transfer)" (Spiro et al., 1995, p. 93-94). Principles of CFT include providing multiple representations of content; criss-crossing (comparing and linking) of cases and concepts to create complex, interconnected domain landscapes; and assembling diverse knowledge sources for application (Spiro et al., 1988).

Spiro and colleagues (1992) argued that the development of CF is necessary for transfer of learning to new problems and situations. CF includes the "ability to represent knowledge from different conceptual and case perspectives and then, when the knowledge must later be used, the ability to construct from those different conceptual and case representations a knowledge *ensemble* tailored to the needs of the understanding or problem-solving situation at hand" (Spiro et al., 1992). Thus, knowledge and thinking from cases need to be flexible in order to be applied in *new* situations.

Knowledge and thinking also needs to be flexible to be applied in the *current* situation. CF is the adjustment of one's problem solving in response to changes in the task (Krems, 1995). Laureiro-Martinez and Brusoni (2018) provided a similar definition within a managerial, business context: "Managers high in cognitive flexibility reflect on the situation at hand, recognize and value diversity in viewpoints, and integrate such diversity in their own decision processes" (p. 1031).

Part of adjusting to task changes is switching between two types of problem solving: "fast" decision-making based on habits and "slow" decision-making that explores "new courses of action" (Laureiro-Martínez & Brusoni, 2018, p. 1031). Fast decision-making works well for well-structured problems, while slow-decision making is required for ill-structured problems. In this dissertation study, the introduction of the first zinger turns the activity into an ill-structured one, requiring participants to use CF to switch from fast decision-making to slow decision-making.

Cognitive Flexibility Scale

According to the Cognitive Flexibility Scale, CF is “a person’s (a) awareness that in any given situation there are options and alternatives available, (b) willingness to be flexible and adapt to the situation, and (c) self-efficacy in being flexible. In any given situation, a person has a choice about how to behave” (M. M. Martin & Rubin, 1995, p. 623). The instrument has high construct and concurrent validity, and a test-retest correlation of .83 (M. M. Martin & Rubin, 1995).

Operationalizing Cognitive Flexibility

In this dissertation study, CF is conceptualized as (Souid & Koszalka, 2018):

a. Thinking about knowledge from different perspectives (Laureiro-Martínez & Brusoni, 2018; Spiro et al., 1988);
b. Making interconnections between content and cases (Spiro et al., 1988);
c. Considering alternatives (M. M. Martin & Rubin, 1995, p. 623); and
d. Adjusting one’s problem solving as the task changes (Krems, 1995; Laureiro-Martínez & Brusoni, 2018)

Expert-Like Thinking

"Because ID is a complex, ill-defined skill, instructional designers must be able to analyze a variety of problem situations and to adapt their knowledge to devise effective strategies to fit each particular situation. As students develop in their ability to do this, they begin to achieve what we believe comprises the essence of 'thinking like an ID expert'" (Ertmer & Stepich, 2005, p. 42).

ID experts and ID novices think differently (Ertmer et al., 2009; Ertmer & Stepich, 2005; Tawfik et al., 2017). Experts think flexibly (Ertmer & Stepich, 2005; Perez & Emery, 2008;

Rowland, 1992; York & Ertmer, 2011), exhibit complex thought about ill-structured problems (Eseryel, 2006), adapt solutions to unique problems (Hardré et al., 2006), and are better at dealing with ambiguity (Fortney & Yamagata-Lynch, 2013). In addition, experts have strategic knowledge, such as knowing what to do when a solution fails or when information is missing (Perez & Emery, 2008).While many of the methods taught in ID PD advocate for flexible and iterative practice, novices are not exhibiting iterative problem solving in the workplace (Fortney & Yamagata-Lynch, 2013).

Case-Based Method

Expert-Like Thinking is Needed for Real-World Problems

Expert-like thinking is required to solve ill-structured problems found in the real world (L. S. Shulman, 1992). Unfortunately, expertise requires "a minimum of ten years of intense training" (Ericsson et al., 2007, p. 118) that includes deliberate practice, deliberate thinking (reflection), and coaching (Ericsson et al., 2007). Long lead times were acceptable when traditional apprenticeships were used to transmit knowledge and observable skills from an expert to a novice (Collins et al., 1991). However, traditional apprenticeships have been replaced with PD that is much shorter. Thus, learners do not have sufficient time or coaching to develop expertise within PD, resulting in difficulty dealing with real-world problems after graduation. To facilitate transfer, teaching methods need to provide learners with vicarious experience.

Definition of Case-based Method and Case

Note, "the evolving definition of case studies has been marked by both continuity and change" (Barnes et al., 1994, p. 44). Literature on teaching with cases is riddled with varied, indistinct terminology; no universally accepted definition exists (Luo, 2015). This dissertation study will utilize the terminology delineated by Luo (2015).

The *case-based method (CBM)* is "an umbrella term for all methods that utilize cases extensively for pedagogical purposes" (Luo, 2015, p. 5). CBM will be used to describe literature on "case-based instruction, case-based approach, case-based reasoning, and case-based learning" (Luo, 2015, p. 5) when the term is being used to describe a teaching method. A *case* is the instructional object used in CBM.

Transfer Goals, Cases, and Case-based Method

The use of workplace stories (Jonassen & Hernandez-Serrano, 2002) or hypothetical, realistic stories related to practice (Ertmer & Russell, 1995) can support transfer. These stories are *cases* (Golich, 2000; L. S. Shulman, 1992), "objects of instruction [that]…present new information, concepts, and theories" (Ertmer & Russell, 1995, p. 24). Cases support knowledge-focused transfer by *providing knowledge* about past and possible situations.

Cases are utilized within the *case-based method (CBM)*, "a teaching method which requires students to actively participate in real or hypothetical problem situations, reflecting the kind of experiences naturally encountered in the discipline under study" (Ertmer & Russell, 1995, p. 24). CBM allows novices to "draw on experts' wisdom, as they might do while apprenticing under live experts" (H. Kim & Hannafin, 2008). CBM can be used to help novices develop critical thinking (Ertmer & Russell, 1995), problem-solving (Ertmer & Russell, 1995), and cognitive flexibility (Jonassen, 1992). In other words, learning activities involving cases support thought-focused transfer by *prompting more expert-like thinking* (L. S. Shulman, 1992)*, including CF,* about the situations described in the case.

Benefits of Cases and Case-based Method

"Novices do not have the benefit of years of experience, yet they are expected to perform upon graduation" (Souid & Koszalka, 2018). Ertmer and Cennamo (1995) suggested that to allow for transfer of knowledge from academic to non-academic settings, learners need to define and solve real-world problems during PD. Cases, simulating authentic or realistic problems, can be used to bridge theory and practice (Ertmer & Russell, 1995; Graf, 1991; Hudspeth & Knirk, 1989; Julian et al., 2000) and allow learners to benefit vicariously from experts' experiences (Rowland, 1992; Rowland et al., 1992).

Limitations of Cases and Case-based Method

However, there are limitations to CBM (Souid & Koszalka, 2018). Even with real cases, the format in which they are presented may not represent realistic complexity (S. M. Williams, 1992); for example, context details (Jonassen, 2008) may be missing. Romiszowski (1991) stated that CBM does not completely simulate the decision-making process because some constraints and stresses may be missing (p. 3-4). "In summary, cases may not reflect the context, constraints, and stresses of real-world problems, resulting in stunted decision-making during the learning process" (Souid & Koszalka, 2018). To teach IDs to perform PM responsibilities, cases need to reflect the *messiness* of real-world projects to simulate the *thought and action* required for practice.

Connection between Profession's Problems and its Transfer Goals

Kennedy (1990) asserted that professions need to dictate which transfer goal they will emphasize, or how they will balance the goals. Similarly, Sykes and Bird (1992) stated, "Although occupational comparisons are useful, each occupation also faces a distinctive set of problems, employs ideas related to these problems, and constitutes a materially distinctive environment for case teaching" (p. 458). Therefore, the nature of the profession and its practice dictates its problem set, and the profession's problem set dictates how novices should be trained.

Variability in transfer goals and problem types has contributed to the wide variety of case and CBM types. Some types may be better suited than others to promote the development of CF and judgment.

Comparison of Case Types

Krems (1995) defined CF as "a person's ability to adjust his or her problem solving as task demands are modified" (p. 202). Most variations of CBM may not fully promote CF because they do not include modification of task demands (e.g., emerging or changing constraints) or adjustment of problem solving (Krems, 1995) (Table 6).

Traditional static cases

Static cases often replicate initial analysis and planning activities, but do not replicate the flexible thinking and judgments required to manage successful projects under changing conditions. Traditional, stationary cases have been described as having a defect called the 'Harvard Type Virus' (as cited in Zhu, Yan, & Sun, 2010) due to their failure to be authentic and relevant for real-world practice.

Multi-part cases

Other CBM designs utilize *multi-part cases* (Barnes et al., 1994) to divide the problem scenario based on cliff-hangers (Wassermann, 1994), e.g. critical moments requiring the protagonist to make a decision (Souid & Koszalka, 2018). After discussing the situation presented in the first part of the case (Case A), learners receive more information (Case B) on what the protagonist decided and the outcome of their decision (Barnes et al., 1994). "When new information is presented in multi-part cases, it does not affect the problem constraints; rather, it moves the narrative forward for further discussion" (Souid & Koszalka, 2018). Thus, learners are not necessarily prompted to make decisions about the case, rather; they discuss possible solutions before being presented with an "answer" (Barnes et al., 1994).

Table 6

Comparison of Case-based Methods

Design Component	CBM with Static Cases (as typically described in the literature)	CBM with Multi-part Cases (Barnes et al., 1994)	CBM with Progressive Cases
Definition/ description	A case with constraints that do not emerge or change during the learning process.	A case that has multiple parts in the form of "episodes".	A case with constraints that emerge or change during the learning process.
Gradual disclosure of information	No, all information is presented at the beginning of the learning activity.	Yes, more information is presented about what the character decided or what happened in the scenario.	Yes, new information is presented in the form of zingers. Information affects "task demands" and requires "adjustment of… problem solving" (Krems, 1995)
Constraints change or emerge	No	No. Narrative progresses with what "happened next" followed by more discussion.	Yes, zingers are presented.
Adjustment of problem solving	No	No, case parts are "episodes". Can be considered new problems as the outcome from previous episode is disclosed.	Yes, zingers require learners to adjust their problem solving and work. The original problem is still being solved.
Dominant learning activities	Discussion	Discussion	Generative, collaborative activity
Decisions in the case	Learners propose and discuss decisions.	Learners propose and discuss decisions.	Learners discuss and make decisions within their teams. Decisions are reflected in deliverables/ assignments.
Outcome pre-determined	Yes, either the outcome of the case is shared with the learners or it is left open-ended.	Yes, either the outcome of the case is shared with the learners or it is left open-ended.	Learners are "creating" their case outcomes through action. Learners produce a solution.
Development of CF	CF possible if multiple perspectives are discussed and cases are compared. However, learners are not required to adjust their problem solving.	CF possible if multiple perspectives are discussed and cases are compared. However, learners are not required to adjust their problem solving.	Yes, high level of CF is possible. Multiple perspectives are discussed in teams. Cases are compared (teams share work with class). Learners adjust problem solving to react to zingers.

Progressive cases

Static cases that present all of the required information (Nendaz et al., 2000) up-front in a linear narrative (Grossman, 1992) do not reflect dynamic, real-world practice. In particular, static cases do not prompt learners to "build something that endures, including the ability to bounce back from setbacks that are inevitable…[nor] adapt creatively to a cognitively ambiguous and structurally emergent environment" (Jackson, 2011, p. 148). Researchers suggested that cases can be more dynamic if the instructor presents hypothetical adjustments (S. M. Williams, 1992) or unexpected events (Lee-kelley, 2018).

Progressive cases have the following distinguishable features:

- *Gradual disclosure of information:* New information is provided during the learning experience (Souid & Koszalka, 2015, 2018).
- *Changing task demands:* Progressive cases have emerging or changing constraints that requires learners to adjust their problem solving (Souid & Koszalka, 2015, 2018).
- *Thought and action:* Progressive cases require learners to think about the case and solve the problem through action (e.g., develop a tangible solution). This includes active decision making. Progressive cases require learners to make decisions, and their decisions affect the outcome of the case (ex. case solution, product, plan, etc.).

Examples of Case-based Methods

The following section discusses examples of CBM designs in business PD, medical PD, ID PD, and PM PD. The examples are assessed against the characteristics of progressive cases: *gradual disclosure of information*, *changing tasks demands*, and *thought and action* (Table 7). They are also assessed on additional dimensions: the *cost* to develop the case and whether the case involves *outside partners*, like actors or guest speakers.

Table 7

Examples of Case-based Method and Progressive Case Characteristics

Article	Context	Gradual Disclosure of Info	Task Demands Change	Thought and Action	Low Cost to Produce	Require Outside Partners
Nendaz et al., 2000*	**Medical PD**	**Yes**	**Yes**	**Yes**	**Yes**	**No**
Vogt & Schaffner, 2016*	**Medical PD**	**Yes**	**Yes**	**Yes**	**Yes**	**No**
Hong & Yu, 2017 *	**Medical PD**	**Yes**	**Yes**	**Yes**	**Yes**	**No**
Conradi et al., 2009 *	Medical PD	Yes	Yes	Yes	No[a]	No
Benedict, 2010	Medical PD	Yes	No	Yes	No	No
Rowland et al., 1992	ID PD	Yes	No	No	Yes[b]	Yes
Souid & Koszalka, 2015	**ID PD**	**Yes**	**Yes**	**No**	**Yes**	**No**
Souid & Koszalka, 2018 *	**ID PD**	**Yes**	**Yes**	**Yes**	**Yes**	**No**
Córdoba & Piki, 2012*	PM PD	Yes	Yes	Yes	Yes	Yes
Lee-kelley, 2018*	PM PD	Yes	Yes	Yes	No	No
A. Martin, 2000*	PM PD	Yes	Yes	Yes	No	No
Rumeser & Emsley, 2019*	PM PD	Yes	Yes	Yes	No	No
Zwikael & Gonen, 2007*	PM PD	Yes	Yes	Yes	No	No
Vanhoucke et al., 2005*	PM PD	Yes	Yes	Yes	No	No

Note. Progressive cases are starred. Bolded items are low cost with no outside partners.

[a] Used free virtual world software but requires peripheral equipment.

[b] Used video recordings.

Case-based Method in Business Professional Development

CBM originated in business PD (Barnes et al., 1994). Harvard Business Publishing (*About Us*, 2019), one of the most popular sources for business cases, develops *brief cases* (static or multi-part cases that are "5-8 pages long plus exhibits") and online simulations. A search for "project management" generates over 270 cases and one online simulation.

Traditional static cases fail to represent real-world practice (as cited in Zhu, Yan, & Sun, 2010). Researchers investigated ways to make CBM more authentic and realistic. Jennings (2002) compared three case designs in a business course: a static case discussion; a project-based case involving developing a plan for a hypothetical business; and a *live case* involving consultation with a real company. The hypothetical, project-based case was perceived most positively by learners because it allowed for integrated learning and experimentation (Jennings, 2002, p. 660).

While working with real clients can be realistic (Charlebois & Foti, 2017; Theroux, 2009) and facilitate learning (Culpin & Scott, 2012), live cases are difficult to execute (Jennings, 2002; Roth & Smith, 2009). Thus, research is needed to validate CBM designs that engage learners in realistic, dynamic problems without necessarily putting the learners in the problem context.

Case-based Method in Medical Professional Development

Some CBM designs in medical PD require learners to request additional information about the case, approximating how medical professionals communicate with patients (Vogt & Schaffner, 2016). Nendaz et al. (2000) compared a vignette case, a static case where all essential information was presented at once, and a chief complaint case. In the chief complaint case, learners acquired additional information by asking questions and requesting tests. Once the learners received the answers/ results, they moved forward in the case to make new decisions. The chief complaint case has all the characteristics of a progressive case: *gradual disclosure of information*, *changing task demands*, and *thought and action*.

Hong and Yu (2017) conducted a randomized, experiment comparing a static case and a face-to-face, progressive case. Learners were tasked to develop a case plan for a patient. Additional information was provided following the time sequence of the patient's illness, requiring learners to revise their case plan based on new information. Learners who participated in the progressive case developed higher levels of critical thinking because the case "created a scenario that was close to the 'real nursing situation'...[and learners experienced] the complete nursing process" (Hong & Yu, 2017, p. 21). Thus, the progressive case was more realistic and facilitated the development of thinking strategies.

High-tech simulations (*virtual patients*) engage learners in realistic and dynamic problems (Benedict, 2010; Conradi et al., 2009). Some virtual patients require learners to interact with the simulation and ask questions (Conradi et al., 2009). The outcome of the case is based on the culmination of the learner's decisions (Benedict, 2010; Conradi et al., 2009). However, not all virtual patient simulations are progressive. Benedict's (2010) branched decision case is a multi-part case because feedback was provided after each decision (e.g., episode). While virtual patients provide a dynamic learning experience, they are expensive and difficult to design (Conradi et al., 2009; Vogt & Schaffner, 2016). Thus, there is a need to research low-cost CBM designs that will engage learners in dynamic problems.

Case-based Method in Instructional Design Professional Development

ID PD should include CBM (Ertmer & Russell, 1995; Fortney & Yamagata-Lynch, 2013; Graf, 1991; Sugar, 2014) to develop ID knowledge and practice (Bennett, 2010; Julian et al., 2000) and CF (Jonassen et al., 1997; Souid & Koszalka, 2015, 2018). The literature outlines a variety of CBM designs including use of hypertext (Bennett, 2010; Jonassen et al., 1997; Julian et al., 2000), online discussion boards (Stepich et al., 2001), video (Rowland et al., 1992), and face-to-face discussion (Souid & Koszalka, 2015).

Hypertext may help learners develop CF by presenting information nonlinearly through links (Spiro et al., 1992), representing information in different ways (Spiro et al., 1988), and supporting the comparison of cases (Spiro et al., 2007). However, these cases do not reflect the dynamic nature of real-world projects because the constraints do not change.

Rowland et al. (1992) described using *multi-part* video cases to gradually disclose information. The video case was paused at certain decision points to allow for discussion. When the video resumed, the solution was presented, and another decision point was set up. Thus, a new problem was presented in each part of the video. Learners were not prompted to adjust their problem solving to a change in task demands.

This dissertation study is a part of a research agenda on developing dynamic learning experiences to model the messiness of real-world practice to prepare ID novices for the workplace. In their first study on the topic, Souid and Koszalka (2015) developed a face-to-face, ID case with gradual disclosure of information. The case involved a performance problem in a corporate setting. The case began with a manager asking the instructional designers to develop training to a specific skill. During the case, more information about the company and the employees' previous training experiences emerged, requiring learners to adjust their problem solving and solutions. Learners reported gaining a better understanding of ID and problem analysis. Souid and Koszalka's (2015) study provided support for using gradual disclosure of information and changing task demands to better replicate real-world ID practice.

In the pilot for this dissertation study, Souid and Koszalka (2018) continued their investigation of cases with emerging constraints in an online, graduate PM course for ID students. They added a generative, collaborative activity (e.g., developing a PM plan) to require learners to take action when responding to zingers. This is similar to other CBM designs in ID PD that involve the learners taking action to develop a written solution (Jonassen et al., 1997; Julian et al., 2000) or a prototype for a real-world client (Bennett, 2010).

Case-based Method in Project Management Professional Development

PM students value learning transferable skills through the use of case studies, interactive projects, and web-based simulations (Ashleigh et al., 2012). Demetriadis, Papadopoulos, Stamelos, & Fischer (2008) developed web cases informed by CFT. The interface included question prompts and links so learners could compare cases to develop CF. However, their CBM design did not include gradual disclosure of information or changing task demands.

Cordoba and Piki's (2012) progressive case engaged learners in a collaborative project based on an authentic case. Groups were tasked to develop a project proposal. As they worked, new information was presented that required the learners to be flexible or adjust.

In Lee-kelley's (2018) study, experienced PMs participated in a 3-day, face-to-face simulation. The participants worked in groups to deliver a solution (plans, a presentation, and reflection paper). On the third day of the simulation, unexpected events were introduced that changed the case problem and required revision of the solution. Surprisingly, experienced PMs had difficulty reacting to unexpected events because they were not reflective experts.

Martin (2000) developed a computer-based, progressive case for PM PD. In the simulation, groups were led through the major events of a construction project. Phase 1 included hiring contractors based on the triple constraint (cost, quality, and time estimates). In Phase 2, unexpected events are introduced to replicate real-world challenges. The learners made decisions throughout the simulation that had consequences on the outcome of the case. Learners described the simulation as interactive and experiential. Learners reported learning that: "Unanticipated problems are inevitable. Additional costs and delays can frustrate well worked out plans. Decisions have to be made under uncertainty" (A. Martin, 2000, p. 209).

Serious PM games are learning experiences that simulate the complexity of real-world projects (Rumeser & Emsley, 2019). Like other CBM types, serious PM games can support the development of decision making, problem solving, and critical thinking (Rumeser & Emsley, 2019). Rumeser and Emsley's (2019) study involved having students who had less than two years of PM work experience (92% of participants) play two computer-based serious games. Both games required the learners to "crash the schedule" to deliver a product sooner—like zinger 2 in this dissertation study. After learners decided which project activities to crash, the computer simulation updated the project cost and duration. There was also an element of randomness to where new critical paths would emerge. These elements changed the demands of the task in the next round of the simulation. The researchers found that the serious games improved participants' decision making.

Zwikael and Gonen (2007) studied the impact of a computer-supported game on undergraduate students' perceptions of their PM knowledge. During the game, realistic and unexpected events (like the zingers in this dissertation study) occurred during project execution. After players decided how to respond, the simulation continued to the next phase of the project life cycle and culminated in a final project budget based on their actions during the game. The researchers found that the simulation taught participants about the "unstructured area of project execution, and [gave] the student a taste of real-life experience" (Zwikael & Gonen, 2007, p. 495). However, this was based on participants' subjective opinions of their levels of PM knowledge, rather than observing their thoughts and actions during the case or measuring their PM knowledge with a validated instrument.

Vanhoucke, Vereecke, and Gemmel's (2005) paper described a serious game that simulated the complexity of project scheduling and trade-offs between time and cost via the triple-constraint. The simulation began with a project and its schedule. They were asked to "crash" or shorten the project duration. Learners' decisions during the game affected the project duration and cost. This computer-based simulation game included unexpected occurrences that either benefited or hurt the project. Learners' decisions throughout the simulation culminated in a final project cost and schedule. The authors did not report on the effectiveness or learners' experiences.

In summary, static and multi-part cases are the most popular form of cases, especially in business and PM PD. This section focused on examples of cases engaging learners in dynamic problems. Many of these examples require coordination with real clients or expensive software. The goal of this dissertation study is to inform the design of low-cost, low-barrier-of-entry progressive cases to prepare novices to respond to unexpected events and solve messy problems.

Research Methods used to Study Case-based Methods

A variety of research methods have been used to study CBM including the *case study research method (CSRM)* (e.g., Ashleigh et al., 2012; Bennett, 2010; Córdoba & Piki, 2012; Julian et al., 2000), *design-based research* (I. Choi & Lee, 2009), *experiments* (Banning, 2003; Hong & Yu, 2017; Tawfik & Jonassen, 2013), and *quasi-experiments* (Demetriadis et al., 2008).

Across these designs, data collection methods included *interviews* (Córdoba & Piki, 2012; Julian et al., 2000), *focus groups* (Ashleigh et al., 2012; Córdoba & Piki, 2012), *questionnaires* (Jennings, 2002; Theroux, 2009), *pre-test/post-test* (Banning, 2003; Tawfik & Jonassen, 2013), and *document analysis* (Bennett, 2010).

Many studies on CBM across contexts measured participants' perceptions of their learning (Culpin & Scott, 2012; Jennings, 2002; Julian et al., 2000; Theroux, 2009; Zwikael & Gonen, 2007). While measuring perceived learning and attitudes can contribute to our understanding, it creates a gap between "what is true in the *real world* (i.e., the importance of decision-making skill in managing complex projects) and what is true in the *serious game world"* (Rumeser & Emsley, 2019, p. 25). In other words, studies that measure perceived learning and attitudes are one step removed from the real-world phenomena. Some studies included more authentic measures such as observing participants' behavior (Córdoba & Piki, 2012; Lee-kelley, 2018), assessing the quality of responses to case questions (Julian et al., 2000; Nendaz et al., 2000; Rumeser & Emsley, 2019; Tawfik & Jonassen, 2013), and measuring critical thinking with a validated instrument (Hong & Yu, 2017).

This dissertation study adds value by measuring participants' thinking skills with a validated instrument, describing their learning process while they engaged with a dynamic problem, and assessing the quality of their thoughts and actions.

Research Context

In this dissertation study, the use of *progressive* case studies was investigated within an online, graduate, PM course for ID students. This dissertation study is part of a line of research investigating variations of CBM (Souid & Koszalka, 2015, 2018). In the first study, Souid and Koszalka (2015) implemented a multi-part case in a face-to-face, introductory, ID course. The case walked the learners through the ADDIE (Analyze, Design, Develop, Implement, Evaluate) process. The case started with a manager asking an ID to develop training for his team. Learners discussed the case in episodes mirroring the ADDIE process. Learners were highly engaged during the session and reported developing conceptual understanding of ID practice, especially the importance of asking questions and seeking information during a needs assessment. The results provided support for low-tech and low-cost CBM, requiring only PowerPoint and free online tools.

Then, Souid and Koszalka (2018) conducted a pilot study to inform this dissertation. Prior to the pilot study, student *teams* were presented with *static cases;* the course design did not include unexpected events. Teams were able to follow a linear process, using templates, to develop their PM plans to solve the case problem. PM plans outlined items such as scope, resources, and time necessary for the design of an instructional product (Project Management Institute, 2017). (Note, teams were not designing the instruction or managing a design project beyond the development of the PM plan.)

In the pilot study (Spring 2018), progressive cases were added to the course to better reflect the *dynamic* nature of real-world design projects (Souid & Koszalka, 2018). During the case, two realistic and unexpected challenges, *zingers*, were presented during the semester, requiring students to adjust their thinking, judgments, and PM plans. CSRM was used to describe the learning process during a progressive case by tracking participants' CF and PM judgment in thought and action dimensions over time. The preliminary results of the pilot suggested that participants understood the importance of responding to unexpected events, being flexible, balancing constraints, and managing interdependencies, but did not execute their thoughts consistently on their PM plans.

This dissertation study (Spring 2019) is a replication of the pilot test. It used the same instructional intervention, in the same course, and similar methodology with a new group of participants. Differences between the pilot and dissertation methodologies are outlined in Chapter 3.

Note, the instructor of the course in the pilot study and this dissertation study was the dissertation chair. The researcher developed the zingers with the instructor. She did not have any presence in the course and did not interact with the participants.

While completing her dissertation work, the researcher worked full-time designing instruction for business students in higher education and developing employee training for a corporation.

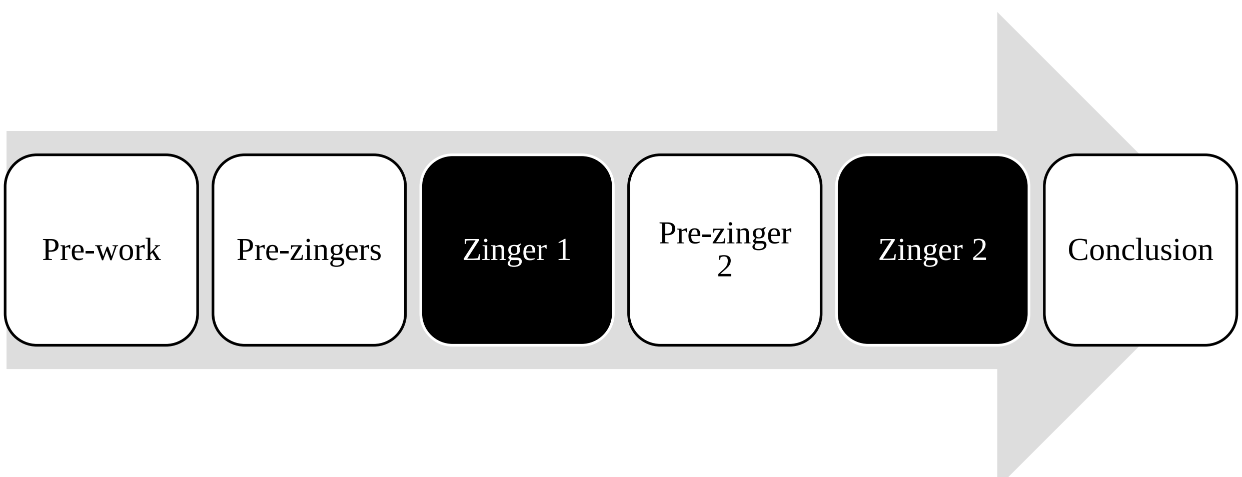
Course Design

The design of the online course included a variety of synchronous (ex. virtual sessions) and asynchronous tools (ex. discussion boards), scaffolds (ex. worksheets, templates), and learning activities (ex. group project, CBM with progressive case). This design intended to involve students in *thought and action* to develop expert-like thinking strategies (e.g., CF and PM judgment) and practice strategies (e.g., flexible and iterative planning).

The course has six sequential phases: *pre-work, pre-zingers, zinger 1, pre-zinger 2, zinger 2, and conclusion* (Figure 1).

Figure 1

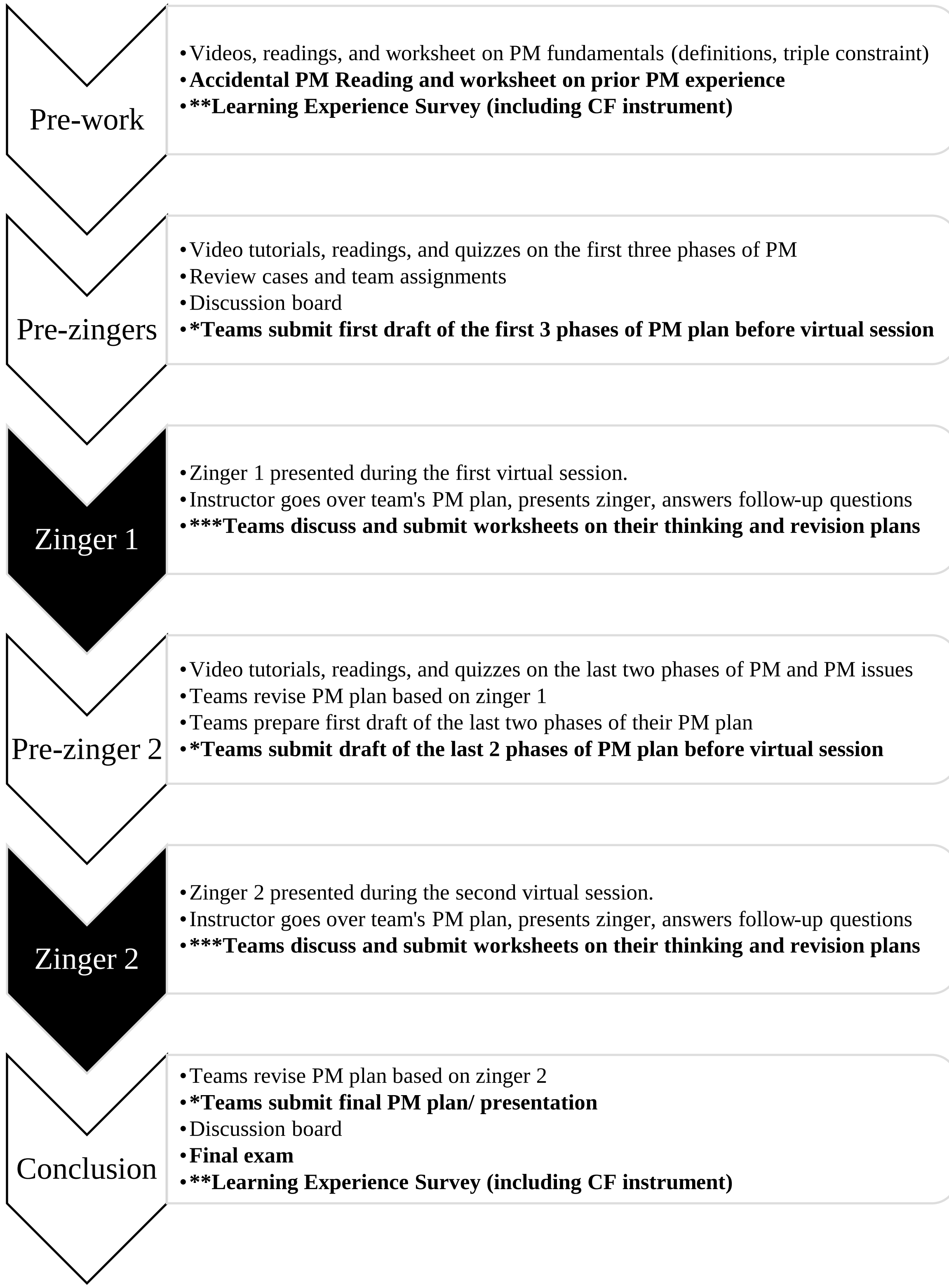
Course Phases



In the pre-work phase, students learned about the triple constraint, PM phases, and elements of a PM plan (Figure 2). The students also read about accidental PMs (Reich et al., 2012) and completed a worksheet on their prior PM experience. Then, each team was assigned a case and tasked to develop a PM plan to design instruction to solve the case problem.

Figure 2

Course Timeline and Activities



The instructor asked each team to meet with her twice during the semester in *virtual sessions* (synchronous web conferences) scheduled approximately one-third and two-thirds into the semester. (Only members of the team and the instructor attended. It was not a whole-class session.) Teams were required to submit drafts of their PM plans before each virtual session. In the first half of the virtual session, teams presented their PM plan drafts. The instructor provided feedback and additional instruction to ensure that the students understood the key aspects of PM planning. In the second half of the virtual session, the team was presented with a zinger that required an adjustment of their thinking, judgment, and PM plan. The zingers were modeled after authentic PM challenges (Butt et al., 2016): increase in scope (addition of a multimedia element in the instruction) and shortened timeline (earlier delivery of the product). The instructor, playing the role of a client representative, talked to the team about the zinger and answered any follow-up questions. This exchange provided students with an opportunity to practice negotiation (S. M. Kim, 2015), interaction (York & Ertmer, 2011), and collaboration with stakeholders (Davis & Radford, 2014; Sugar & Luterbach, 2016).

The instructor asked the team to discuss the zinger and submit a worksheet (Appendix A) documenting their thinking and how they will revise their PM plan to address the new constraints. The worksheet prompted teams to list their assumptions (Wassermann, 1994) and consider how the zinger affected their PM plan—including, “time line, human resources, etc.”. Afterwards, the team returned to the virtual session to debrief with the instructor.

After each virtual session, teams had time to revise their PM plans to respond to the zinger.

At the end of the course, students submitted their final PM plans and presentations, took a final exam (Appendix B) on PM content, and participated in a discussion board.

Progressive Case Design

There were four cases in the course (Appendix C). Each case took place in a different context: training for student athletes, K-12 teacher professional development, translation of a face-to-face science course to delivery online, and ID in a business setting.

The cases were initially presented as *static* cases, like they were in the original course design (pre-Spring 2018). The case contained detailed information (Doyle, 1990; Graf, 1991; Luo et al., 2018) about the context, problem, proposed instructional solution, available personnel and resources, and goals. The cases ended with a description of the teams' assignment—develop a PM plan and presentation with the following parts: *executive summary, define, plan, organize, control, and close*. These sections were based on Weiss and Wysocki's (1992) five phases of PM. Teams were provided with a template to support the development of the PM plan. The template was a checklist of items to include in each phase (Appendix D).

When zingers were presented during the virtual session, the case became *progressive*; that is, the case now contained emerging or changing constraints. In the pilot study and dissertation study, the introduction of new information in the progressive case was relatively simple. The instructor described the requested changes and answered any follow-up questions. This instructional intervention was a low-cost and low-barrier-for-entry method to inform the development of instruction to prepare novices to respond to unexpected events and solve messy problems.

Progressive Case Design Rationale

This section outlines the rationale, with supporting literature, for the design of the progressive cases used in this dissertation study.

Unexpected Events. Students were not informed that the assigned case will change during the semester. They began the case believing it was static, like a majority of CBM methods. After zingers were introduced, the case became progressive, reflecting the messy nature of real-world projects. When the problem is messy, typical "school" strategies may no longer work (ex. following templates linearly) because students need to adjust their thinking, judgments, and PM plans to respond to the unexpected events.

These zingers were based on realistic and common changes that occur in projects (Heagney, 2016; McBride, 2013; T. C. Williams, 2011). They were designed to be substantial enough to have the power to prompt CF and PM judgment. For example, the second zinger required students to reduce the project duration by 20%. This percentage was believed to be large enough to cause ripples in the PM plan, if students are keeping the triple constraint balanced and the plan consistent.

Thought. The progressive case was designed to involve students in thought and action. First, it requires students to engage in flexible thought and flexible actions. When the constraints change or emerge, students need to adjust their problem solving (Krems, 1995). Static and multi-part cases are not designed to prompt flexible thinking because the task does not change.

The progressive case also requires students to use PM judgment. Just like IDs managing real-world design projects, teams need to balance the *triple constraint.* When demands for a constraint increase, PM judgment is needed to make compromises in other areas. For example, increasing scope may require additional resources (cost), and tightening deadlines may require reducing scope (ex. delivering a product with fewer features). When teams are responding to the zingers, they need to use PM judgment to identify *interdependent parts* in their PM plan to ensure consistency.

Action. Static cases are not active (Mesny, 2013). The progressive case in this dissertation study requires students to participate in a generative activity (Wassermann, 1994), *acting* to develop a PM plan as a case solution. The learning experience goes beyond hypothetical discussions of decisions and solutions, which are the focus of many CBM variations (Merserth, 1992). Williams (1992) suggested that learners need to work on "entire problem-solving cycle of planning, executing, evaluating, and revising problem solutions" (p. 414) beyond evaluating other's solutions. In this dissertation study, the progressive case involves all problem-solving phases.

Cases that have pre-determined outcomes are not interactive (Andrews et al., 2009). In this progressive case, students are engaged in active decision making—their decisions affect the case outcome (Conradi et al., 2009; Graham et al., 1992; A. Martin, 2000).

Flexible and Iterative Practice Strategies. The introduction of zingers may better reflect flexible and iterative ID and PM practice strategies. This course design supports iteration by providing ample time between zingers for teams to revise their PM plans.

Multiple Solutions. Cases should have several solutions (Graf, 1991; Grossman, 1992) and represent a variety of effective practices (Sykes & Bird, 1992). According to international PM standards, when facing a change, a PM has three main options: avoid, mitigate, and accept (Project Management Institute, 2017). The teams have these options as well. The aim is to have the teams to provide sound rationale for their decisions based on various inputs (case constraints and problem, initial PM plan, zinger characteristics, etc.). Thus, there are multiple correct solutions to the progressive case.

Low-cost/ Low-barrier-for-entry. Pedagogical innovations must be "economical and practical to produce" (Theroux, 2009, p. 367) to be adopted in business PD. Motowidlo (1990) found that low-fidelity simulations can have high validity for managerial skills. Hong and Yu (2017) developed a multi-episode case without using high-tech virtual patients. Vogt and Schaffner (2016) used synchronous conferencing to implement evolving cases in an online setting for medical PD. Similarly, this dissertation study uses basic online teaching technologies to present the progressive case.

Table 8

Theory, Design Components, and Intended Outcomes

Domain	Theoretical Principles	Design Components	Intended Outcomes (observable behavior)/ *Thoughts*	Intended Outcomes (observable behavior)/ *Actions*
Cognitive Flexibility	**Flexible Thinking:** Consider different perspectives (Spiro et al., 1988). Make connections (Spiro et al., 1988). Seeking alternatives (M. M. Martin & Rubin, 1995, p. 623). Adjust problem solving when task changes (Krems, 1995)	Zingers are used to change the constraints of the PM planning task.	Reflections and discussions that exhibit flexible thinking (ex. generate alternative solutions, questioning the client's perspective).	In response to zingers, revise PM plans to accommodate the new constraints.
PM judgment	**Triple Constraint:** Balance the tension between competing demands of time, cost, and quality/scope (Maley, 2012; Project Management Institute, 2004). Build contingency (Harrin, 2013) and flexibility (Guldemond et al., 2008) to protect the balance of constraints.	Case includes constraints such as deadlines, resources available, and description of desired scope. Zingers affect time and scope constraints. PM plan includes sections related to these constraints.	Reflections and discussions that exhibit understanding of the triple constraint (ex. discussing trade-offs, building slack in schedule).	In response to zingers, revise PM plans to balance triple constraint—involves making compromises in time, cost, scope/quality.
	Interdependent parts: Parts of PM plans and projects are dependent on one another. A change may result in a ripple effect to other parts. Planning is iterative. (Project Management Institute, 2017)	PM plan template contains parts aligned with the five phases of PM (Weiss & Wysocki, 1992). Course deadlines reflect sequential development starting at define and ending at close, but zingers interrupt sequential progress.	Reflections and discussions that exhibit the relationship between parts of the PM plan.	In response to zingers, revise PM plans across the whole document, including parts that have already been drafted—this ensures consistency.

Aligning Theory, Design Components, and Intended Outcomes

Theoretical principles in CF and PM judgment informed the design of the progressive case to bring about observable behaviors (Table 8). These behaviors are split into two categories: thought and action. Participants are thinking or acting with CF or PM judgment if their behaviors align with the intended outcomes.

Best Practice Thought and Actions in Response to the Zingers

According to international PM standards, when facing a project change, a PM can avoid, mitigate, or accept the change (Project Management Institute, 2017). The participants in this dissertation study had the same options; however, they were not informed of this to avoid biasing their responses. As discussed in the previous section, there are multiple possible solutions to the progressive case. Teams could develop a unique solution to their case, and the researcher was not looking for one "correct" answer. The teams' responses were evaluated based on what an ID or PM expert might consider or do and best practices and theories in ID and PM literature. Thus, participants' solutions and their rationale were assessed in terms of CF and PM Judgment.

The following section outlines best practices in dealing with scope and time changes in a project. These best practices inform the dissertation study's code scheme (outlined in Chapter 3).

Zinger 1: Increase in Scope.

> *"Clearly, there is no end of good ideas, but those ideas also have to be evaluated in context to the trade-offs in budget, time, and windows of opportunity that their inclusion into the project represent" (Wood, 2011, p. 219).*

The first zinger is a request to increase the project's scope; the client wants to add a multimedia element to the instruction using a new technology. The zinger simulates three common reasons for project scope adjustments: changes in business needs, leveraging new technology, and adding features requested by stakeholders (Davis & Radford, 2014).

Table 9

Summary of Best Practices and Common Misconceptions/ Errors when Dealing with Scope and Time Changes

	Best Practices: Avoiding	Best Practices: Mitigating/ Accepting	Common Misconceptions/ Errors
Cognitive Flexibility	□ Think about alternatives to the client's request, including saying no and providing realistic options □ Consider whether the proposed change is consistent with the project priorities	□ Adjust thinking and PM plans to the new task demands □ Seek alternative solutions and perspectives □ Use flexible decision making (ex. late locking) □ Consider project priorities	□ Over-promising: Accepting the client's request without asking for clarification, questioning the need/ value, or trying to compromise) □ Not updating the PM plan after a change is accepted
PM Judgment	□ Ask for justification for the change □ Explain the impact of the change using the triple constraint □ Predict cumulative impacts of proposed changes, especially late in the project □ Explain how the change will result in ripple effects	□ Anticipate the impact □ Write a flexible PM plan, ex. iterative scheduling □ Use progressive elaboration □ Build contingency □ Keep triple constraint balanced by re-negotiating or making trade-offs □ Ripple the impact of the change throughout the plan □ Ensure the plan is consistent □ Reallocate under-utilized resources □ Add resources on the critical path to reduce project time (depends on the nature of the task)	□ Inconsistent PM plan □ Underestimating impact of the change □ Insufficient contingency □ Making optimistic assumptions: Expecting the project team to work harder (ex. paid or unpaid overtime); hiring more people to reduce project time □ Imbalanced triple constraint (ex. not charging the client for increased scope) □ Inaccurate estimations of activity duration and productivity

Requests for additional product features are common occurrences in PM practice (Heagney, 2016; T. C. Williams, 2011). Most project scope changes are intended to enhance the project deliverable (Cooper & Reichelt, 2004). Projects need to meet the client's needs (Bennatan, 2000), and their needs may change over time (Cooper & Reichelt, 2004). Even if the change will improve the project deliverable (Cooper & Reichelt, 2004), a PM needs to consider the impact of any scope change (Harrin, 2013).

The following are best practices and common misconceptions or errors when dealing with scope and time changes in a project (Table 9).

Avoiding the Scope Change: Flexible Thinking. A PM may draw upon CF to decide to avoid a scope change. Instead of accepting the client's perspective blindly, a PM with high CF considers alternative solutions (Cooper & Reichelt, 2004; M. M. Martin & Rubin, 1995) and adjusts their problem solving when the demands of the task change (Krems, 1995). In other words, they are not 'yes people', accepting all client demands (Doraiswamy & Shiv, 2012). It is important for the PM to consider the project's priorities (Kerzner, 2001; McBride, 2013). Not all change requests are critical or important (Harrin, 2013). If the requested scope change does not align with the project priorities, the PM may decide to reject the change.

Avoiding the Scope Change: Project Management Judgment. A PM with high PM judgment could avoid a scope change by pushing back to keep the triple constraint balanced (Doraiswamy & Shiv, 2012; Project Management Institute, 2017). To do this, they would need to provide a strong argument outlining how a change in scope would affect the project's cost and timeline (Doraiswamy & Shiv, 2012; Harrin, 2013; T. C. Williams, 2011), and how changing one part of the project would have ripple effects to other parts of the project (Cooper & Reichelt, 2004). In fact, a PM may decide to reject all change requests late in the project (T. C. Williams, 2011) to minimize reworking or demolishing completed parts of the product. Also, the PM needs to consider *cumulative impacts*. "Cumulative impact is the phenomenon of the impact of many changes being greater than the sum of the impact of the individual changes" (Cooper & Reichelt, 2004). This is partly due to the interdependency of project parts. The PM needs to communicate these impacts with the client, and consider alternatives and tradeoffs together (Cooper & Reichelt, 2004).

If the client insists on the change and provides sufficient justification (T. C. Williams, 2011), the PM could decide to mitigate or accept the change.

Mitigating the Impact of the Scope Change: Flexible Thinking. A PM can mitigate the impact of a scope change by engaging in two types of flexible decision making: *late locking* (iterative front-end planning) and *continuous step-by-step locking* (incremental decision making) (Olsson, 2006). These strategies delay decision making until the project and its constraints become more certain. If a scope change is requested before the PM makes all the decisions about the project, the change can be incorporated more seamlessly.

In agile projects, the PM can receive feedback during each stage of development to clarify requirements and reduce uncertainty (Davis & Radford, 2014; Doraiswamy & Shiv, 2012; Harrin, 2013). This is related to *progressive elaboration* which entails developing broad plans early in the project and making them more detailed as objectives and deliverables are crystalized (Project Management Institute, 2004). If the original PM plan is broad, the PM can respond to the scope change by adding detail to their PM plan.

Mitigating the Impact of the Scope Change: Project Management Judgment. A PM with high PM Judgment will try to minimize the impact of the change (Cooper & Reichelt, 2004; Harrin, 2013) if it cannot be avoided. It is easier to minimize the impact of a change if the PM plan is flexible (Doraiswamy & Shiv, 2012; Guldemond et al., 2008). For example, the PM may use *progressive elaboration* to develop broad plans that can be more easily adjusted when change occurs (Project Management Institute, 2004). If the PM built contingency in their original plan (Doraiswamy & Shiv, 2012; Project Management Institute, 2017), they can use the extra time and resources to accommodate the scope increase without affecting the project's core, resulting in fewer ripples (Cooper & Reichelt, 2004).

The PM would still need to request additional resources or time to accommodate the scope increase (Maley, 2012; Project Management Institute, 2004, 2017) to keep the triple constraint balanced.

Accepting the Scope Change: Flexible Thinking. Before accepting a scope change, a PM with high CF may reach out to the client or various stakeholders for alternative solutions and more perspectives (Cooper & Reichelt, 2004; Davis & Radford, 2014; Spiro et al., 1992). If the PM decides to accept the change, they would need to adjust their thinking and plans (Krems, 1995). A PM with high CF would rethink and revise parts of the PM plan that are related to scope. For example, they may add new work activities to build the new product features.

Accepting the Scope Change: Project Management Judgment. When accepting a scope change, high levels of PM judgment are required to ripple the impact of the change throughout the plan to ensure consistency (Project Management Institute, 2017). PMs need to anticipate the impact (Davis & Radford, 2014; Maley, 2012; Project Management Institute, 2004, 2017) on all aspects of the project. In this progressive case, introducing a new multimedia element may impact many parts of a PM plan such as: project goals, success criteria, and job descriptions. For example, the PM will need to hire someone who knows how to use the new technology or train someone on the project team (Bennatan, 2000; Davis & Radford, 2014).

While accommodating the scope increase, the PM needs consider the triple constraint (Maley, 2012; Project Management Institute, 2004, 2017). Developing a new multimedia element will require time and may take resources away from other project deliverables, reducing their quality (Doraiswamy & Shiv, 2012).

Zinger 2: Decrease in Time.

"What I learned from all those hard knocks is that thinking that 'we'll just do whatever it takes' or that 'its's just got to happen' doesn't work. Resources don't magically fall from the sky, no one's willing to sleep on a cot in the lab, requirements don't just drop off the scope of work, and even if—through some minor miracle—you pull it off, there's no way you're gonna [sic] get a hat trick…it's just not repeatable or sustainable" (McBride, 2013).

PMs will invariably be given unrealistic timelines for their projects (McBride, 2013). The second zinger is a request to deliver the product sooner (Heagney, 2016). The client wants to reduce the project timeline by 20%.

Best practices when avoiding, mitigating, and accepting time changes in a project are discussed in this section. Note, many of the best practices for scope change can also be used when dealing with time changes.

Avoiding the Time Change: Flexible Thinking. A PM with low CF may be a "yes person", accepting the client's perspective without considering alternatives. A PM with higher CF would challenge unrealistic end dates by providing realistic options to achieve the project goals (McBride, 2013). This could involve walking the client through "what-if" scenarios to fully consider alternative solutions and trade-offs (McBride, 2013). The PM may also give the client a *conditional yes.* After giving a *conditional yes,* the PM would investigate/ predict the impacts of the change, present their findings to the client, and finally negotiate (McBride, 2013).

Avoiding the Time Change: Project Management Judgment. As discussed for scope changes, a PM with high PM judgment would ask for justification for the change (T. C. Williams, 2011); they would avoid any changes that cannot be justified. "If the change doesn't make sense—if it doesn't add value or should not be processed for other reasons—push back" (Heagney, 2016, p. 151).

The PM would explain the impact of the change on the triple constraint (Maley, 2012; Project Management Institute, 2004, 2017). Reducing the project time would require a reduction in scope (ex. remove a product feature) or quality (ex. less multimedia), or increased cost (ex. resources) (Heagney, 2016; McBride, 2013).

Mitigating the Impact of the Time Change: Flexible Thinking. The best practices discussed in the scope change section can be used for mitigating time changes. PMs should not develop detailed project schedules and tasks at the very beginning of a project (Doraiswamy & Shiv, 2012). Progressive elaboration and flexible decision-making produce flexible PM plans that can more easily absorb reductions in project timelines (Guldemond et al., 2008; Olsson, 2006; Project Management Institute, 2004).

Mitigating the Impact of the Time Change: Project Management Judgment. If a project is at risk of being late, the PM can consider options to minimize the impact (Doraiswamy & Shiv, 2012; T. C. Williams, 2011). This may include utilizing more of a team member's time if they are not being fully utilized. For example, a graphic designer may only have 10 hours of tasks scheduled in a 40-hour work week. To respond to the reduction in the project's timeline, the PM may assign other tasks to the graphic designer to fully utilize their work week.

A PM with PM judgment estimates the *productive time* of their teams *realistically* (Biafore & Stover, 2012; Davis & Radford, 2014). The graphic designer will not be able complete 40 hours of project work during a 40-hour work week. Half of knowledge workers' time (Biafore & Stover, 2012; Heagney, 2016) is "stolen" (Kerzner, 2001) by non-project work. Also, workers need to take breaks, get tired, and wait for inputs from others (Heagney, 2016).

If the PM built *contingency* in their original plan, they can draw upon the provisional time and resources to shorten the project timeline (Doraiswamy & Shiv, 2012). Contingencies can mitigate the impact of unforeseen events (Harrin, 2013; Rolstada˚s, 2004) by providing some *slack* (Project Management Institute, 2017) or cushion to protect the "core" of the project. If extra time or resources can be used to shorten the timeline, the rest of the PM plan can remain unchanged.

Contingency can take many forms. The PM can hire extra people at the beginning of the project to avoid costly decisions (ex. bottle-necks, delays, overtime) later on (Guldemond et al., 2008). The PM can also buffer the schedule, by adding time to the end of the project (Biafore & Stover, 2012). Estimations of the length of project tasks can be buffered as well, but these buffers should be made explicit so the project team does not rely on the extra time (McBride, 2013).

Accepting the Time Change: Flexible Thinking. "The schedule is not a static document, and is therefore subject to constant change" (Bennatan, 2000). If the PM decides to accept the reduction in project timeline, they would need to adjust their thinking and plans (Krems, 1995). A PM with high CF would rethink and revise parts of the PM plan that are related to overall duration of the project. For example, a PM who thinks flexibly would iteratively refine the project schedule and activity list (Bennatan, 2000) based on emerging constraints.

Accepting the Time Change: Project Management Judgment. As discussed in the scope change section, when a PM accepts a time change, they need to anticipate the impact of the change (Maley, 2012; Project Management Institute, 2004, 2017) on all aspects of the project. These changes need to ripple throughout the plan to ensure that the PM plan is consistent (Project Management Institute, 2017).

The triple constraint needs to remain balanced (Maley, 2012; Project Management Institute, 2004, 2017). Three options will be discussed here: adding resources (ex. team members), decreasing scope/ quality, and optimizing the schedule (Heagney, 2016).

The PM may decide to add someone to the project team (McBride, 2013); however, that will require reducing resources elsewhere to keep the cost balanced (Doraiswamy & Shiv, 2012) or renegotiating with the client. If the PM decides to add people to a task, they need to consider the following: "Assigning more than one person to a task shortens the duration, although this approach works only to up to a point. Too many people on the same assignment can increase the duration. In addition, some tasks can't be shortened by adding resources, such as having a baby, driving a truck route, or holding a meeting" (Biafore & Stover, 2012). Thus, a PM needs to ensure that the task can be divided among team members. Also, adding people onto tasks can make them *crowded* (e.g. people get in each other's way and slow down the process) (Heagney, 2016). The PM also needs to consider that the project duration is dependent on the critical path. Adding people or resources to activities outside of the critical path does not reduce the project duration (Bennatan, 2000), and would not meet the client's request for earlier product delivery.

Second, the PM may decide to decrease the scope of the project to decrease the timeline (McBride, 2013). This could be done by prioritizing the "must have" requirements in the deliverables (Doraiswamy & Shiv, 2012; McBride, 2013). The PM can present realistic options to the client and walk them through what-if scenarios to decide on trade-offs, such as removing a product feature or reducing the quality (McBride, 2013).

Third, the PM may also optimize the schedule to make the work more efficient. For example, the PM can look at the critical path and see if any work can be done in parallel (McBride, 2013).

Common Misconceptions and Errors

This section outlines common misconceptions and errors when dealing with change requests of all types (Table 9). Like the best practices, these inform the code scheme outlined in the next chapter.

Over-promising. Some PMs are too eager to please the client. Promising the client to accept a change request without doing due diligence demonstrates inflexible thinking and poor PM judgment. For example, bowing to pressure to increase the project scope can result in project delays, increased costs, and decreased quality of project deliverables (Doraiswamy & Shiv, 2012). Thus, “Project managers wanting to be nice and allowing all changes are hurting the project, product, and the customer” (T. C. Williams, 2011).

It is best for the PM to be honest and not promise anything that they cannot deliver (Bennatan, 2000; McBride, 2013). Instead, the PM can negotiate a compromise that would be possible for both parties (Bennatan, 2000; McBride, 2013).

Not Updating the Project Management Plan after a Change is Accepted/ Inconsistent Project Management Plan. A common mistake is not updating the project plan when a change is approved (Heagney, 2016). This can result in an inconsistent PM plan. PMs need to realize the consequences of their decisions (Kliem, 2011), and ripple the impact of their decisions throughout the PM plan (Cooper & Reichelt, 2004).

Underestimating Impact of the Change. Another common mistake is underestimating the impact of changes (Cooper & Reichelt, 2004). PMs may not realize the cumulative impacts of the change (Cooper & Reichelt, 2004). For example, a PM cannot accept the scope increase without considering its impact on: the schedule, budget, risks, quality, and resources (Harrin, 2013). Furthermore, adding scope to a project can result in more overtime and hiring, reduced productivity, slower progress, rework, and lower morale (Cooper & Reichelt, 2004). Thus, the PM needs to consider direct impacts and indirect impacts.

Insufficient Contingency. PMs need to build contingency in their PM plans to cover the impact of unexpected events and change requests (Doraiswamy & Shiv, 2012; Harrin, 2013; Rolstada˚s, 2004). An example of a common error is starting with project plans that require overtime (Heagney, 2016). Some PMs may overload their resources, assigning more work than the team can complete (Doraiswamy & Shiv, 2012). Both practices leave little to no slack in the PM plan.

Making Optimistic Assumptions: Expecting the Project Team to Work Harder (ex. Paid or Unpaid Overtime); Hiring More People to Reduce Project Time. One optimistic assumption a PM may make is that the project team can work harder (Heagney, 2016) to accommodate a scope increase or reduction in timeline. It is not recommended that the project team work harder or faster (Heagney, 2016). Tired workers are less productive (Heagney, 2016) and produce work with errors (Bennatan, 2000). This results in rework that puts the project farther behind (Cooper & Reichelt, 2004; Heagney, 2016).

An example of this is forced overtime. Many PMs rely on paid or un-paid overtime to accelerate work process (Cooper & Reichelt, 2004; Guldemond et al., 2008). Overtime can be a viable option as long as productivity is maintained (Kerzner, 2001); however, this is unlikely if overtime is prolonged. Thus, it is best practice to develop PM plans that do not require overtime (Guldemond et al., 2008; Heagney, 2016), and only use it when necessary (ex. when there are changes or problems) (Heagney, 2016; Kerzner, 2001) for short periods of time.

PMs may also try to “crash the schedule” by hiring additional people (Guldemond et al., 2008; McBride, 2013) to work on tasks on the critical path (Bennatan, 2000). PMs must exercise

PM judgment to execute this practice effectively. Sometimes adding more people to a task doesn't help speed it up (Bennatan, 2000; McBride, 2013). According to Brooks' Law, it is not good practice to add more people to late projects (Dimitrov, 2020). The new people need ramp-up time (Bennatan, 2000; Dimitrov, 2020). Because there will be a learning curve, they will not contribute productive work hours to the project right away (Bennatan, 2000).

Also, some tasks' durations are not dependent on the number of people assigned (Bennatan, 2000), such as having a baby. Adding resources to these tasks will not speed up the project. There is also a point of diminishing returns (Heagney, 2016). When people are added to a task, non-project tasks such as meetings, coordination, and communications take more time (Bennatan, 2000). Also, when there are too many people working on a task, they can get in each other's way, reducing their productivity (Heagney, 2016).

Imbalanced Triple Constraint (ex. Not Charging the Client for Increased Scope). "If is left unchecked, changes to the project plan cause significant imbalance regarding scope, schedule, and budget…[PMs need to] gauge their overall impact on the project and react accordingly" (Heagney, 2016, p. 147). For example, a PM should not accept an increase in scope without requesting additional resources or time (Bennatan, 2000; T. C. Williams, 2011) or removing other product features (McBride, 2013).

Inaccurate Estimations of Activity Duration and Productivity. PMs need to make estimations about the duration of tasks and their team's productivity to create a schedule. Since it is difficult to make accurate estimations, many PM plans are flawed.

Some PMs equate the duration of project tasks with the effort (hours of work) needed for the task (Bennatan, 2000; Biafore & Stover, 2012). For example, a project may be scheduled to last five months but doesn't require five months of work from the team (Bennatan, 2000). This may result in underutilization of resources.

In addition, PMs tend to make optimistic estimations when the project is uncertain (Davis & Radford, 2014). They overestimate the productivity of their team, forgetting that about half of their time (Biafore & Stover, 2012; Heagney, 2016) is "stolen" (Kerzner, 2001) by non-project work. PMs may also overlook the impact of overtime on the team's productivity (Cooper & Reichelt, 2004; Heagney, 2016). Prolonged use of overtime may cause errors and rework that puts the project further behind schedule (Cooper & Reichelt, 2004; Heagney, 2016). Biafore and Stover (2012) suggest that PMs make optimistic, most likely, and pessimistic estimates and then calculate a weighted average to reduce bias.

Section Summary

In this dissertation study, participants' thoughts and actions were coded based on type (CF or PM judgment) and quality (strong or weak). The best practices and common misconceptions/ errors outlined in this section informed the data analysis framework to code the data in these dimensions.

Research Questions

The following research questions were investigated:

1. How do teams respond to unexpected changes during PM planning tasks?
2. Are participants exhibiting CF during PM planning tasks?
3. How does implementing zingers in a progressive case affect CF in participants over a semester?
4. Are participants exhibiting PM judgment during PM planning tasks?

5. How does implementing zingers in a progressive case affect PM judgment over a semester?

Summary

"The PM literature has yet to address the question of how higher education PM courses can help managers derive solutions that have true utility in the workplace…close examination of the fit between intended learning outcomes and real-time performance is scant"(Lee-kelley, 2018, p. 199).

PD needs to reflect real-world practice to support the transfer of learning (Tracey & Boling, 2014). Thought-focused transfer prepares learners to analyze and interpret new situations, and adapt their skills to accommodate unique characteristics of the problem (Kennedy, 1990). Since both ID and PM projects are *messy*, ID PD and PM PD need to support thought-focused transfer to prepare novices to respond to unexpected events and solve *messy* problems. This dissertation study examines ID novices' CF and judgment responses during problem solving tasks in PM and a variation of CBM to assess its ability to better support the development of CF and judgment in students.

The next chapter outlines this dissertation study's research methodology. The chapter begins with an overview of the *case study research method (CSRM)*, including a discussion of *document analysis* and *time-series analysis*. Then, data collection and data analysis methods will be outlined. The data analysis framework, based on the best practices and common misconceptions/ errors from this chapter, will be shared. The chapter ends with a discussion of possible methodology issues.

Chapter 3: Method

Introduction

This dissertation study seeks to inform the design of professional development (PD), particularly the design of instructional *cases*, to prepare novices to respond to unexpected events and solve messy problems. To simulate real-world project management (PM) practice, *zingers*, or realistic and unexpected challenges, were introduced in different parts of the *progressive case*, interrupting the PM work process and prompting reactions involving flexible thinking and judgment. Working on *complex* and *dynamic* project problems may help novices develop the expert-like *thinking strategies* and *practice strategies* required in the workplace.

This dissertation study employed the *case study research method* (CSRM) and *document analysis* to describe the learning process while participants engaged with a dynamic problem within a progressive case. A *time-series analysis* was used to track flexible thinking (cognitive flexibility, CF) and PM judgment in *thought and action* dimensions over a semester. Since time-series analysis can support causal inferences, early and late code patterns were compared to describe how participating in a progressive case influenced the development of CF and PM judgment.

CSRM will be described, including a discussion of *document analysis* and *time-series analysis.* Data collection and data analysis methods, including a data analysis framework, will be outlined. The chapter ends with consideration of possible methodological issues.

Research Design

Participants

The course was offered by a graduate instructional design (ID) program. The students in the course were asked if they would like to participate in the study. The term, *participants,* refers to students who provided IRB consent. A description of the participants is included in the next chapter (Table 16).

The students in this study worked on the progressive case in teams. At the beginning of the course, students reviewed the four case studies and provided their first and second choices to the instructor. The instructor formed the teams by considering the students' preferences while also trying to create teams consisting of students who were similar to or different from one another. In the end, most students were assigned a case that met one of their preferences. For the most part, it appeared that students chose their cases based on the context. For example, student athletes tend to prefer to work on the case in that context.

Methodology

Case Study Research Method

The *case study research method (CSRM)* is an "empirical method that investigates a contemporary phenomenon ("the case") in depth and within its real world context" (Yin, 2018, p. 15).

Documentation is a source of evidence in CSRM (Creswell, 2011; Stake, 1995; Yin, 2018). The strengths of documentation are:

- "Stable—can be reviewed repeatedly
- Unobtrusive—not created as a result of the case study
- Specific—can contain the exact names, references, and details of an event
- Broad—can cover a long span of time, many events, and many settings" (Yin, 2018, p. 114).

This dissertation study relied on document evidence collected during the course. The online learning management system (Blackboard) can record interactions and store students' work.

Time-series analysis (a specific analytic strategy within CSRM) was used to track CF and PM judgment over time (Yin, 2018). Since the worksheets and PM plans were collected *after* zingers were presented, the time-series can be considered a *chronological sequence.* This type of time-series analysis applies when “some events must always be followed by other events, on a *contingency* basis” (Yin, 2018, p. 185). Chronological sequences can be used to “investigate presumed causal relationships—because the basic sequence of a cause and its effect cannot be temporally inverted” (Yin, 2018, pp. 184–185). Thus, changes in CF and PM judgment over the semester can be attributed to the presentation of zingers because of their chronological and contingent sequence.

While the time-series was used to make inferences on how participating in a progressive case may influence CF and PM judgment thoughts and actions, the focus of this dissertation study was to *describe* the learning process. The aim was to use CSRM to describe participants’ learning process in order to inform instructional theories and case-based method (CBM) designs, rather than measuring the impact of an intervention.

Data Collection

The data collected during the course include (Table 10):

1. **Worksheet** on prior PM experiences: Participants read an article about accidental PMs and then completed a worksheet. Participants’ answers to the following question were analyzed: “Are you an accidental PM- why or why not?”.
2. Two measures of participants’ CF using the **Cognitive Flexibility Scale** (M. M. Martin & Rubin, 1995) (*pre-measure* and *post-measure*): Participants completed the Cognitive Flexibility Scale instrument through the learning management system before any zingers were presented and at the end of the course.

3. Two drafts of **PM plans** (after zinger 1 (*revision draft 1*) and after zinger 2 (*revision draft 2)*): Teams were tasked to write a PM plan to design instruction to address the problem presented in their case scenario. They were provided a template following the five phases of PM (Appendix D)—Define, Organize, Plan, Control, and Close (Weiss & Wysocki, 1992). PM plans consisted of a combination of text (Word or PDF), tables (activity lists and schedules), and charts (Gantt chart, flow chart).
4. Recordings of **virtual sessions** (two for each team) for initial reactions to the zingers and insight on what the teams considered and discussed: The instructor met with each team via video conferencing for 1-2 hours. In the first half of the meeting, the instructor led a discussion about the participants' use of course resources. Then the teams shared their PM plans and the instructor provided feedback. In the second half of the meeting, the instructor presented the zinger and answered any follow-up questions. Then, the instructor left the meeting to allow the team to discuss how they will respond to the zinger. Note, only the last discussion was analyzed because this dissertation study focused on how participants responded to unexpected events during project planning.
5. Two **worksheets**, completed during the virtual sessions, documenting participants' assumptions and reasoning, and what the team agreed on: The worksheets were administered using the survey feature in the learning management system. Participants were asked to describe their understanding of what the client wanted, list their assumptions, outline how the zinger will change their plan, and postulate possible ways the team can incorporate the change (Appendix A)
6. **Final exams** documenting participants' knowledge of/ reflections on PM and how they responded to zingers: The final exam was a written exam administered through the

learning management system (Appendix B). The open-ended questions analyzed for this dissertation study asked participants about the most important characteristics for good PMs, the most important PM phases, and a reflection on the zingers and their responses to them.

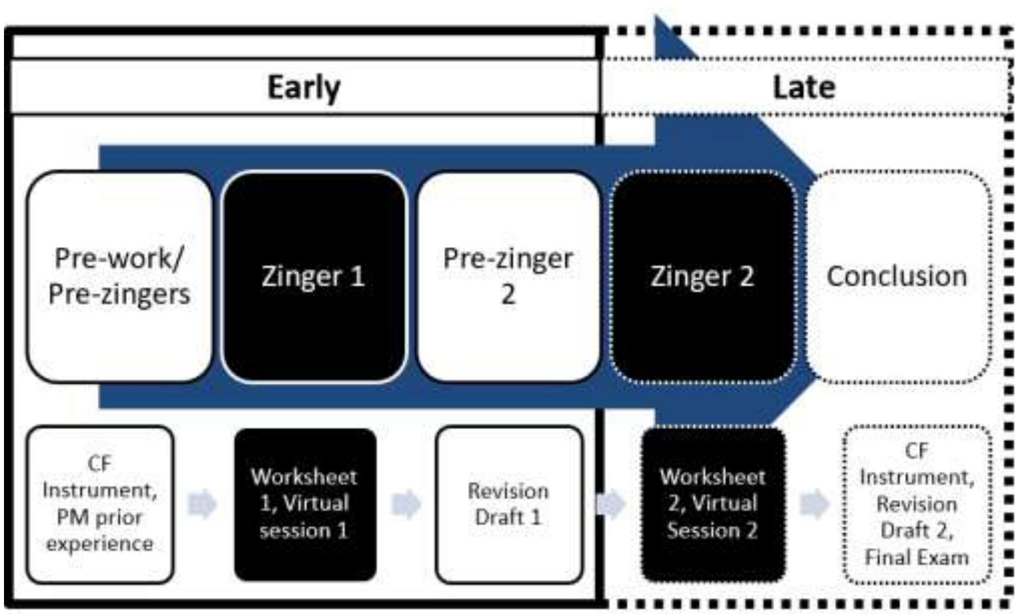
Table 10

Early and Late Phase Data Sources

Early Phase	Late Phase
Worksheet on prior PM experience	Post-measure of participants' CF using the Cognitive Flexibility Scale (M. M. Martin & Rubin, 1995)
Pre-measure of participants' CF using the Cognitive Flexibility Scale (M. M. Martin & Rubin, 1995)	Worksheet 2
Worksheet 1	Recording of virtual session 2
Recording of virtual session 1	Revision draft 2
Revision Draft 1	Final exam

Figure 3

Data Collection in Course Phases



Course documents such as the worksheets, PM plans, and final exam provided observable measures of CF and PM judgment. Final exams and the CF instrument were measures of an individual's CF and PM judgment without the support of team members.

To support the time-series analysis, the data were divided into an early phase and a late phase (Table 10). Data types were selected across the six phases of the course to investigate the development of CF and PM judgment over time (Table 10, Figure 3).

Instrument

To measure changes in CF over time, the Cognitive Flexibility Scale (M. M. Martin & Rubin, 1995) was administered before the first zinger was presented and at the end of the course. According to the Cognitive Flexibility Scale (Table 11), CF is "a person's (a) awareness that in any given situation there are options and alternatives available, (b) willingness to be flexible and adapt to the situation, and (c) self-efficacy in being flexible. In any given situation, a person has a choice about how to behave" (M. M. Martin & Rubin, 1995, p. 623). The instrument has high construct and concurrent validity, and a test-retest correlation of .83 (M. M. Martin & Rubin, 1995).

Data Analysis

Stake (1995) suggested, "Spend the best analytic time on the best data" (p. 84). Thus, the initial data analysis focused on a portion of the collected data. The final exam, CF instrument, and worksheets were coded for all participants. The final exam was consulted first to identify participants' take-aways and reflections as they relate to the research questions. Then, the average pre-measure and post-measure of participants' CF were compared. In the next phase of data analysis, worksheets were analyzed to identify how teams responded to the zingers.

Table 11

Topics in the Cognitive Flexibility Scale

Item Number	Description of Item (M. M. Martin & Rubin, 1995)
1	Communicate with a variety of methods
2	Avoid situations
3	Autonomy to make decisions
4	Solve difficult problems
5	Choose actions
6	Creatively solve problems
7	Act appropriately in any situation
8	Relationship between decisions and behavior
9	Recognize alternative ways of behaving in a situation
10	Applying knowledge in real-life situations
11	Consider alternatives when solving a problem
12	Confident to try different behaviors

Based on a preliminary review of all the teams' data and revision plans, some teams were selected for full data analysis. These teams were selected to "optimize understanding" of the case (Stake, 1995, p. 13). The teams were selected based on the quality of data available. Also, the selected teams had different approaches to the zinger, resulting in a richer case. The revision drafts of PM plan, virtual sessions, and PM prior experience were analyzed for the selected teams.

Overall Process. The following process was used to analyze the data:

Cleaning the Data. A participant key was created and identifiers were removed from the course documents. Missing data were noted, such as when a student did not submit an assignment or did not provide IRB consent.

Analyzing CF Pre-measure and Post-measure. The items were scored according to the directions provided by the instrument authors. The average pre-measure and post-measure were calculated and compared.

Coding. Data were analyzed qualitatively using MaxQDA software. The software was used to code the data (Creswell, 2011) and analyze the documents for frequencies (Stake, 1995). "Coding is the process of segmenting and labeling text to form descriptions and broad themes in the data" (Creswell, 2011, p. 243). The process of data coding was iterative (Creswell, 2011). Codes emerged during the data analysis process (Stake, 1995); data were reviewed again to incorporate new codes. This process of *document analysis* was used to describe the case and identify emerging themes (Creswell, 2011) (e.g., patterns (Stake, 1995).

The final exam, worksheets, and revision drafts of PM plan were coded on a sentence level. The virtual sessions were coded based on pieces of dialogue (continuous speech of a participant before stopping or being interrupted). Revision drafts were coded on a sentence level. Each revision within a table or figure was coded.

If there was one team submission or the participants submitted identical PM plans, only one submission was coded. If participants in a team submitted different versions, the unique areas of the PM plan were coded separately (ex. different front-page summaries outlining their response to the zinger).

Synthesizing Themes. Data were synthesized into themes to answer the research questions. For example, early and late code patterns were compared to investigate how progressive cases influenced the development of CF and PM judgment over a semester.

Data Analysis Framework.

Development of the Data Analysis Framework. To inform the dissertation study, a pilot was conducted on the same graduate ID course with different participants. In the pilot study, the data were analyzed twice. First, the data were coded based on CF and PM judgment literature. Based on the first round of coding, a data analysis framework was created. Then, the data were re-analyzed based on the framework.

The dissertation data were initially analyzed using the framework from the pilot; however, some codes emerged or were updated to better reflect the dissertation study and make the research case richer.

Thought, Action, Cognitive Flexibility, and Project Management Judgment: Level 1. Data were collected throughout the course to track the participants' development of CF and PM judgment in thought and action dimensions (Table 12). Both the pilot and dissertation data analysis frameworks categorize the data into thoughts and actions. Thoughts include reflections and discussions about the progressive case (e.g., virtual sessions, worksheets, final exam). The participants' actions were demonstrated on the revision drafts.

Crisscrossing the intended outcomes, CF and PM judgment, with thought and action generates the following categories:

- CF Thought
- CF Action
- PM Judgment (PM J) Thought
- PM Judgment (PM J) Action

These are Level 1 codes (Figure 4).

Table 12

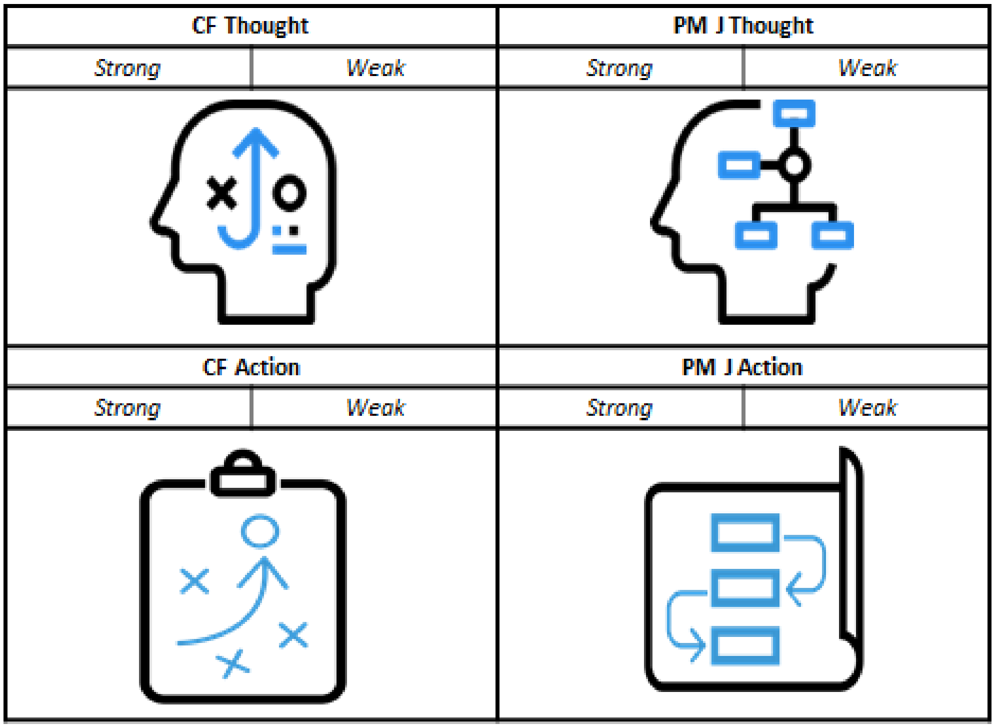
Thought, Action, and Data Collection Across Course Phases

	Early Phase			Late Phase	
Course Phases→	Pre-work/ Pre-Zingers	Zinger 1	Pre-Zinger 2	Zinger 2	Conclusion
Intended *Thought*	*Reflection* on prior PM experience, *initial thinking about the case*	*Analyze* zinger, *Discuss* zinger with team and client rep, *Adjust thinking* (CF), Make *PM judgments* to respond to zinger	Continued *CF and PM judgments* to revise and develop PM plan	*Analyze* zinger, *Discuss* zinger with team and client rep, *Adjust thinking* (CF), Make *PM judgments* to respond to zinger	Continued *CF and PM judgments* to produce a consistent final PM plan that addresses the zingers, *Reflection*
Intended *Action*	*Develop* 1st draft of first 3 phases of PM plan		*Revise* PM plan draft in response to zinger, *Develop* last 2 phases of PM plan		*Revise* PM plan draft in response to zinger, *Submit* final PM plan
			Data Collection		
CF Thought	CF Instrument (pre-measure)	Worksheet 1, Virtual Session Recording 1		Worksheet 2, Virtual Session Recording 2	CF Instrument (post-measure), Final Exam
CF Action			PM Plan: Revision draft 1		PM Plan: Revision draft 2
PM J Thought	Worksheet on Prior PM experience	Worksheet 1, Virtual Session Recording 1		Worksheet 2, Virtual Session Recording 2	Final Exam
PM J Action			PM Plan: Revision draft 1		PM Plan: Revision draft 2

Strong and Weak: Level 1. Each Level 1 thought or action code is designated as strong or weak (Figure 4). Strong codes reflect thoughts and actions prescribed in Cognitive Flexibility Theory (CFT) and PM models. Strong codes are related the best practices for avoiding, mitigating, and accepting change requests outlined in Chapter 2 (Table 13). Weak codes are related to the common misconceptions/ errors outlined in Chapter 2 (Table 14).

Figure 4

Level 1 Codes



Level 1 Icons. Icons are used to illustrate the Level 1 codes (Figure 4). These icons are used throughout the dissertation. Since CF involves adjusting one's thinking when the task changes (Krems, 1995), the symbol for CF is an arrow going around an obstacle. In this dissertation study, PM judgment involves balancing constraints and considering the interdependence of project components. Thus, PM J is represented using flowcharts where separate items are either connected or organized in a sequence. The thought codes include a head to emphasize that these codes describe cognitive processes like assumptions, beliefs, and reflections. For the action codes, similar images are superimposed on paper, rather than within a head. This is to reinforce that action codes were coded on participants' PM plans. When participants executed their thinking on a PM plan, that turned thought into action, and was coded as either CF Action or PM J Action.

Table 13

Alignment of Best Practices with Level 2 Strong Codes

	Avoiding		Mitigating/ Accepting	
	Best Practices	Related Codes	Best Practices	Level 2 Strong Codes
Cognitive Flexibility	• Think about alternatives to the client's request, including saying no and providing realistic options • Consider whether the proposed change is consistent with the project priorities	• Alternatives • Multiple views • Not sure if necessary	• Adjust thinking and PM plans to the new task demands • Seek alternative solutions and perspectives • Use flexible decision making (ex. late locking) • Consider project priorities	• Adjust • Alternatives • ChangeX • Easy to make a change • Flexible • Inevitable change • Multiple views • Not sure if necessary • Positive change • PMs need to deal with change/ problems • Predicting/ planning for change • Problem solving • Unexpected events • *Action: Made a change to accommodate client request (primary to zinger)*
PM Judgment	• Ask for justification for the change • Explain the impact of the change using the triple constraint • Predict cumulative impacts of proposed changes, especially late in the project • Explain how the change will result in ripple effects	• Anticipate impact • Interdependence • Ripple effect • Triple constraint	• Anticipate the impact • Write a flexible PM plan, ex. iterative scheduling • Use progressive elaboration • Build contingency • Keep triple constraint balanced by re-negotiating or making trade-offs • Ripple the impact of the change throughout the plan • Ensure the plan is consistent • Reallocate under-utilized resources • Add resources on the critical path to reduce project time (depends on the nature of the task)	• Anticipate impact • Consistency • Contingency • Front-end planning is not enough • Interdependence • Iteration • Many parts • Minimize effect • Request more resources from client • Ripple effect • Triple constraint • *Action: Made a change to keep things consistent (ripple effect) or to balance a constraint (secondary to the zinger)*

Level 2 Thought Codes. To make the case richer, CF Thought and PM J Thought had Level 2 codes (sub-codes) (Figure 5, Figure 7). The researcher coded the data using the Level 2 codes to investigate which *types of CF and PM judgment* were present.

Unlike the pilot that underwent two rounds of coding, in the dissertation study, the Level 2 codes aggregate into the Level 1 codes. Thus, the Level 1 code frequencies are equal to the total of its Level 2 code frequencies. For example, the total frequency of Strong CF Thought codes is the sum of all the frequencies of its Level 2 codes (ex. adjust, alternatives, etc.).

Table 14

Alignment of Common Misconceptions/ Errors with Level 2 Weak Codes

	Common Misconceptions/ Errors	Level 2 Weak Codes
Cognitive Flexibility	□ Over-promising: Accepting the client's request without asking for clarification, questioning the need/ value, or trying to compromise □ Not updating the PM plan after a change is accepted	□ No change □ Not capable of change □ Promise □ *Action: Statements that a change was not made, note that X did not change, includes participant saying no change was needed*
PM Judgment	□ Inconsistent PM plan □ Underestimating impact of the change □ Insufficient contingency □ Making optimistic assumptions: Expecting the project team to work harder (ex. paid or unpaid overtime); hiring more people to reduce project time □ Imbalanced triple constraint (ex. not charging the client for increased scope) □ Inaccurate estimations of activity duration and productivity	□ Did not balance constraints □ Inconsistent □ Poor reasoning/ assumptions □ *Action: Internal consistencies in the PM plan; Did not balance the constraints (ex. added activity but did not compensate, work harder)*

Note, Level 2 codes in Table 13 and Table 14 are related to the best practices or common misconceptions/ errors, but are not in 1-to-1 alignment. As discussed, most of the Level 2 codes were developed during the pilot study based on CFT and PM literature. These codes may breakdown or combine best practices, misconceptions, or errors. For example, it is best practice to adjust thinking and PM plans to new task demands. The following Strong CF Level 2 codes breakdown this best practice into: adjust, easy to make a change, inevitable change, PMs need to deal with change/ problems, predicting/ planning for change, and unexpected events. Conversely, a few common misconceptions/ errors in PM judgment were combined into a single Weak PM J Level 2 code: Poor reasoning/ assumptions. This code was created during the pilot and worked well with the dissertation data, despite describing more than one type of optimistic assumption.

In the following section, Level 1 codes will be outlined.

Strong CF Thought. Strong CF is demonstrated when participants think flexibly by considering different perspectives (Spiro et al., 1988), seeking alternative solutions (M. M. Martin & Rubin, 1995, p. 623), and adjusting their thinking and PM plans to new task demands (Krems, 1995). If a participant demonstrated this in their discussions and reflections, it fell under one of Strong CF Thought's Level 2 codes (Figure 5).

Strong CF Thought's Level 2 codes are related to best practices when responding to project changes (Table 13):

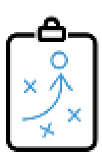
- Think about alternatives to the client's request (M. M. Martin & Rubin, 1995), (Doraiswamy & Shiv, 2012) and provide realistic options (McBride, 2013)
- Consider whether the proposed change is consistent with the project priorities (Harrin, 2013; Kerzner, 2001; McBride, 2013)
- Adjust thinking and PM plans to the new task demands (Krems, 1995)
- Seek alternative solutions and perspectives (Davis & Radford, 2014; Spiro et al., 1992)
- Use flexible decision making (ex. late locking) (Olsson, 2006)

Figure 5

CF Thought Level 2 Codes with Supporting Literature

CF Thought	
Strong	*Weak*
• **Adjust** (Krems, 1995) • **Alternatives** (Krems, 1995; M. M. Martin & Rubin, 1995) • **Change X** (Krems, 1995) • **Easy to make a change** • **Flexible** (Krems, 1995; M. M. Martin & Rubin, 1995; Spiro et al., 2007, 1992, 1987) • **Inevitable change** (Krems, 1995) • **Multiple views** (Krems, 1995; Spiro et al., 1988, 1992) • **Not sure if necessary** (Krems, 1995; Spiro et al., 1988, 1992) • **Positive change** (Cooper & Reichelt, 2004) • **PMs need to deal with change/ problems** (Cooper & Reichelt, 2004) • **Predicting/ planning for change** (Krems, 1995) • **Problem solving** (Krems, 1995; Spiro et al., 1988, 1992) • **Unexpected events** (Krems, 1995)	• **Difficult** (Krems, 1995) • **No change** (Krems, 1995) • **Not capable of change** (Krems, 1995) • **Promise** Krems, 1995; Spiro et al., 1988, 1992) • **Surprise** (Krems, 1995)

Weak CF Thought. If a participant demonstrated inflexible thought in their discussions and reflections, it was coded under one of Weak CF Thought's Level 2 codes (Figure 5). The Weak CF Thought Level 2 codes are related to the common misconceptions and errors made when responding to project changes (Table 14). The misconceptions/ errors and codes fall into two major categories. First, sometimes, PMs *over-promise* (Bennatan, 2000). They accept the client's change request without doing due diligence to make sure that it is necessary, valuable, and feasible. This is related to the promise code (Krems, 1995; Spiro et al., 1988, 1992). Second, it is a common mistake to forget to update the PM plan after a change is accepted (Heagney, 2016). This is related to the rest of the codes in the Weak CF Thought category: no change, not capable of change, and difficult (Krems, 1995).



Strong CF Action. To respond to project changes, participants need to think flexibly and execute this thinking on their PM plans. Strong CF Action was coded when the participant made a revision in their PM plan that demonstrated the execution of flexible thought. The coded segments met one or more of the following criteria:

1. *Revision to accommodate the client's request (zinger).* Strong CF Action was coded when the revision was primary to the zinger constraint. Zinger 1 added an instructional element, increasing the project's scope. Any edits in revision draft 1 related to the project's scope were coded as Strong CF Action. Zinger 2 shortened the project timeline. Edits to the project's timeline were coded as Strong CF Action in revision draft 2.
2. *Revision to the select portions of the PM plan:* In the dissertation study, Strong CF Action was coded when revisions were made to the following sections:
    - Work Breakdown Structure (WBS)
    - Work Activities (unless the revision was made to keep the constraints balanced)
    - Gantt Chart
    - Status/ Variance tables

This distinction emerged during coding to make the analysis more objective. These sections were chosen because they were most likely to be primary to the zinger constraint, and least likely to be a revision for consistency.

Weak CF Action Weak CF Action was coded when the participant did not make a revision to their PM plan (e.g., there was no execution of flexible thinking) (Figure 6). Weak CF Action was coded when one or more of the following were observed in the participants' revision drafts of their PM plans:

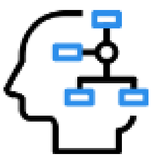
- Participant mentioned not making a revision.
- Researcher noted that a revision was not made to an image in the PM plan.

- Researcher noted that a revision was not made to a section of the PM plan (on a header level).

Figure 6

CF Action Level 2 Codes with Supporting Literature

	CF Action	
	Strong	*Weak*
	**Made a change to accommodate client request (primary to the zinger)** (Krems, 1995) • Zinger 1: adding tech • Zinger 2: shortening time • Changes in WBS, work activities, work packages, Gannt chart, status/ variance tables	**Statements that a change was not made, note that X did not change, includes participant saying no change was needed** (Krems, 1995) • Code "no change" at header level



Strong PM J Thought. Strong PM J is demonstrated when participants *protect or balance the triple constraint* (Maley, 2012; Project Management Institute, 2004) and *manage the interdependent parts* of PM plans (Project Management Institute, 2017).

Figure 7

PM J Thought Level 2 Codes with Supporting Literature

	PM J Thought	
	Strong	*Weak*
	• **Anticipate impact** (Maley, 2012; Project Management Institute, 2004, 2017) • **Can't work harder** (Heagney, 2016) • **Complexity** (Geraldi et al., 2011) • **Consistency** (Project Management Institute, 2017) • **Contingency** (Project Management Institute, 2017) • **Front-end planning is not enough** (Project Management Institute, 2017) • **Interdependence** (Project Management Institute, 2017) • **Iteration** (Project Management Institute, 2017) • **Many parts** (Project Management Institute, 2017) • **Minimize effect** (Maley, 2012; Project Management Institute, 2004, 2017) • **Request more resources from client** (Maley, 2012; Project Management Institute, 2004, 2017) • **Ripple effect** (Project Management Institute, 2017) • **Triple constraint** (Maley, 2012; Project Management Institute, 2004, 2017)	• **Did not balance constraints** (Maley, 2012; Project Management Institute, 2004) • **Inconsistent** (Project Management Institute, 2017) • **Poor reasoning/ assumptions** (Maley, 2012; Project Management Institute, 2004)

If the participant's discussions and reflections exhibited good PM judgment, it was coded using one of Strong PM J's Level 2 codes (Figure 7). Strong PM J Thought Level 2 codes are related to the best practices for avoiding, mitigating, and accepting project changes (Table 13). The best practices can be grouped into six categories:

1. Ask for justification for the change (T. C. Williams, 2011)
2. Impact
    a. Anticipate the impact (Davis & Radford, 2014; Maley, 2012; Project Management Institute, 2004, 2017)
    b. Explain the impact of the change using the triple constraint (Doraiswamy & Shiv, 2012; Harrin, 2013; T. C. Williams, 2011)
    c. Predict cumulative impacts of proposed changes, especially late in the project (Cooper & Reichelt, 2004)
3. Interdependent parts
    a. Explain how the change will result in ripple effects (Cooper & Reichelt, 2004)
    b. Ripple the impact of the change throughout the plan (Cooper & Reichelt, 2004)
    c. Ensure the plan is consistent (Project Management Institute, 2017)
4. Flexibility
    a. Write a flexible PM plan, ex. iterative scheduling (Guldemond et al., 2008)
    b. Use progressive elaboration (Project Management Institute, 2017)
    c. Build contingency (Harrin, 2013)
5. Keep triple constraint balanced by re-negotiating or making trade-offs (Maley, 2012; Project Management Institute, 2004, 2017)
6. Optimize the project

a. Reallocate under-utilized resources (Doraiswamy & Shiv, 2012)

b. Add resources on the critical path to reduce project time (depends on the nature of the task) (Bennatan, 2000)

Weak PM J Thought. Weak PM J Thought was coded when participants demonstrated poor PM judgment related to PM concepts. Weak PM J Thought Level 2 codes (Figure 7) are related to the common misconceptions/ errors around responding to project changes (Table 14):

- Inconsistent PM plan (Project Management Institute, 2017)
- Underestimating impact of the change (Cooper & Reichelt, 2004)
- Insufficient contingency (Doraiswamy & Shiv, 2012; Heagney, 2016)
- Making optimistic assumptions: Expecting the project team to work harder (ex. paid or unpaid overtime) (Heagney, 2016); hiring more people to reduce project time (Bennatan, 2000; McBride, 2013)
- Imbalanced triple constraint (ex. not charging the client for increased scope) (Bennatan, 2000; Heagney, 2016; McBride, 2013; T. C. Williams, 2011)
- Inaccurate estimations of activity duration and productivity (Bennatan, 2000; Biafore & Stover, 2012)

Strong PM J Action. PM judgment is required to develop consistent PM plans (Project Management Institute, 2017) that protect or balance the triple constraint (Maley, 2012; Project Management Institute, 2004). Strong PM J Action was coded (Figure 8) when good PM judgment was *executed* to keep the plan consistent or protect or balance constraints.

Strong PM J Action was coded when one or more of the following were observed:

- Revision to make or keep the plan consistent (ripple effect)

- Revision to balance a constraint (secondary to the zinger): This included using contingency, reassigning tasks, and adding staff (for the time zinger).
- Revision to select portions of the PM plan: In the dissertation study, <u>Strong PM J Action</u> was coded when revisions were made to the following sections:
    - Problem/ opportunity
    - Goals
    - Assumptions/risks
    - Success Criteria
    - Critical Path (Figure 14)
    - Organizational Chart
    - Job Descriptions (Figure 15)
    - Tracking and variance methods (ex. increased frequency)

Figure 8

PM J Action Level 2 Codes with Supporting Literature

	PM J Action	
	Strong	*Weak*
	**Made a change to keep things consistent (ripple effect) or to balance a constraint (secondary to the zinger)** (Project Management Institute, 2017) •Tracking/ variance methods •Balance •Triple constraint •Contingency •Reassigning tasks •Problem/ Opportunity •Goals •Assumptions/ risks •Success Criteria •Critical path •Org chart •Job descriptions •Sequenced new activities	• **(Internal) inconsistencies in the PM plan** (Project Management Institute, 2017) • **Did not balance the constraints (ex. added activity but did not compensate, work harder)** (Project Management Institute, 2017) • Code just once for each type of error within a heading (coding the absence of something)

These sections were chosen because they involve going back to redefine the project or considering implications of other revisions. In other words, revisions to these sections were considered more specialized than the ones coded with Strong CF Action because they require knowledge of the triple constraint and interdependent parts. (Note, each edit or researcher note in the revision draft was coded only once (e.g., either CF Action or PM J Action).)

Weak PM J Action. Weak PM J Action was coded when the participant executed poor PM judgment on their PM plans. Weak PM J Action was coded when one or more of the following were observed:

- Internal consistencies in the PM plan
- Constraints were not balanced

Table 15

Inquiry Questions Based on Data Analysis Framework

Research Questions	Data Analysis Framework
How do teams respond to unexpected changes during PM planning tasks?	• **Prior PM experience:** Do the teams have different levels of prior PM experience? Do teams with different levels of prior PM experience respond to unexpected changes differently? • **Synthesis/ Themes:** How did each team think and act in response to the zingers?
Are participants exhibiting CF during PM planning tasks?	• **Final exam**: Do participants discuss how PMs need to be flexible, adapt tools or techniques, and/or respond to changes? *(Post measure)* • **Cognitive Flexibility Scale responses:** What are the levels of participants' CF? (*Pre and post measures*)
How does implementing zingers in a progressive case affect CF in participants over a semester?	• **Revision drafts:** What is the percentage of Strong CF Action in response to zinger 1? Zinger 2? *(Time series)* • What was the percentage of Strong CF Thought in early phases? Late phases? (*Time series*) • **Cognitive Flexibility Scale responses**: Do participants report having higher CF after experiencing zingers in the case study? *(Pre-post comparison)*
Are participants exhibiting PM judgment during PM planning tasks?	• **Interdependent parts**: Do participants discuss the connections between PM phases and the interdependence of the parts of a PM plan? *(Post measure)* • **Triple constraint**: Do participants discuss importance of balancing constraints? *(Post measure)*
How does implementing zingers in a progressive case affect PM judgment over a semester?	• **Revision drafts:** What is the percentage of Strong PM J Action in response to zinger 1? Zinger 2? *(Time series)* • What was the percentage of Strong PM J Thought in early phases? Late phases? (*Time series*)

These codes were informed by common misconceptions/ errors (Table 14).

Sources of Data, Research Questions, and Inquiry Questions

Yin (2018) stated that there are different levels of questions in the CSRM. One type of question describes the line of inquiry "to remind [the researcher] of the data to be collected, and why" (Yin, 2018, p. 99). Researchers suggested that it is helpful to list the sources of data (e.g., evidence) for each research question (Stake, 1995) and inquiry question (Yin, 2018) (Table 15).

Methodological Issues

Duration

This dissertation study described the learning process during a progressive case over a semester. While discussing their CBM study that took place over a 16-week semester, Choi and colleagues (2014) stated that "insufficient strength or time of instruction" (p. 55) may have threatened their study. Longer instructional interventions may improve the results by increasing the "dosage"; however, the duration of this dissertation study was constrained by the university's semester system.

Designer bias

In this dissertation study, the researcher was not the instructor of the course; however, she designed the zingers with the instructor. While it is very common for ID researchers to design the research intervention (Richey & Klein, 2007), steps need to be taken to mitigate bias. This concern can be addressed by using "carefully structured data-collection instruments and multiple sources of data" (Richey & Klein, 2007, p. 62). This dissertation study focused on observable behaviors (e.g., traces of student's learning (Luo, personal communication, October 23, 2018) from generative learning activities. These data were triangulated (Richey & Klein, 2007; Yin, 2018) by analyzing different course documents: worksheets (2 versions), revision drafts (2 versions), and final exams. As Richey and Klein recommended (2007), an instrument provided a quantitative measure of participants' CF to supplement the qualitative analysis.

Generalizability

The conclusions of this dissertation study are context-bound because they are linked to the implementation of a product in a unique project (Richey & Klein, 2007, p. 13). Yet, conclusions can be generalized beyond the project; "the "lessons learned" from these studies can apply to those who are confronting similar design and development projects" (Richey & Klein, 2007, p. 13). This is similar to *naturalistic generalizations* (Stake, 1995; Stake & Trumbull, 1982) in CSRM.

Generalizing the results of a CSRM study is called *analytic generalization* (Yin, 2018). CSRM is "generalizable to theoretical propositions and not to populations or universes" (Yin, 2018, p. 20). Thus, the findings in this dissertation study may inform theories related to how to train adults to respond to unexpected events or provide support for a new case designs.

Differences between the Pilot and Dissertation Methods

Research studies, like design projects and PM projects, are messy and require the researcher to adjust to their thinking, plans, and solutions. Yin (2018) stated that CSRM designs can be modified based on "new information or discovery during data collection" (p. 63). The plan may change if it will result in a better understanding of the case, and if it is feasible to do so.

Initially, the data analysis framework from the pilot was used to analyze the dissertation data. However, some new codes emerged and a few code definitions were updated. For example, some participants in the dissertation study saw the client's request to add a new technology as a *positive change*, improving the quality of the project deliverable. Thus, <u>positive change</u> was added as a Level 2 code within Strong CF Thought (Level 1 code).

In the pilot study, the data were initially coded based on CF and PM judgment literature. After coding was completed, a data analysis framework was created. Then, the data were re-analyzed based on the framework. In the dissertation study, instead of coding the data twice, the codes from the pilot, and any that emerged during the dissertation study, were organized into the data analysis framework. Thus, in the dissertation study, the Level 2 codes aggregate into the Level 1 codes.

In the pilot study, it was difficult to code the absence of CF Action and PM J Action. In the dissertation study, Weak PM J Action was coded on a header level when the researcher noted that a revision was needed to keep the constraints balanced or plan consistent. In addition, when a section of the plan was not revised, Weak CF Action was coded on a header level. This made the coding for the dissertation study more objective and richer.

Summary

Preparing ID novices for PM responsibilities should thoughtfully and purposively engage learners in *thought and action* around *messy* PM problems to help them develop more expert-like thinking strategies and practice strategies. In this research study, *progressive cases*, cases with emerging or changing constraints, were integrated in an online, graduate-level, PM course to support the development of flexible thinking and PM judgment.

This chapter outlined the methodology of this dissertation study. The *case study research method (CSRM)* was used to describe the learning process while participants engaged in a dynamic problem within a progressive case. Within the CSRM, *time-series analysis* was used to attribute changes over time to the presentation of the zingers within the progressive case.

In the pilot study, a data analysis framework was developed based on best practices, misconceptions, and errors outlined in CF and PM literature. The data analysis framework used in the pilot study was refined during the dissertation study to develop a more objective and rich case. Inquiry questions were drafted to guide the data analysis by identifying what data sources will be used and how data will be compared to answer the research questions.

The next chapter presents the results of the dissertation study, starting with overall trends in the Level 1 codes (CF Thought, PM J Thought, CF Action, and PM J Action). The rest of the chapter will answer the research and inquiry questions.

Chapter 4: Results

Introduction

Professional development (PD) should prepare instructional design (ID) novices for project management (PM) responsibilities by thoughtfully and purposively engaging learners in *thought and action* around authentic, *messy* PM problems. Cases are one way to support this type of PD. To simulate real-world PM practice, *zingers*, or realistic and unexpected challenges, were introduced in different parts of the *progressive case*, interrupting the PM work process and prompting reactions involving flexible thinking and judgment. Working on *complex* and *dynamic* project problems may help novices develop more expert-like *thinking strategies* (e.g., flexible thinking and judgment) and *practice strategies* (e.g., flexible and iterative planning actions). This dissertation study employed the case study research method (CSRM) to describe the learning process during a progressive case by tracking flexible thinking (cognitive flexibility, CF) and PM judgment in *thought and action* dimensions over a semester. It seeks to inform the design of PD, particularly the design of instructional cases, to prepare novices to respond to unexpected events and solve messy problems.

To describe the changes in CF and PM Judgment (PM J) during the progressive case, multiple data points were collected and analyzed to track participants' thoughts and actions over time. This chapter starts with a review of the dissertation methodology, including a description of the participants, and a list of the data sources collected and analyzed. Results of the dissertation study will follow, starting with overall trends within the data analysis framework. The rest of the chapter will answer the following research questions in order:

1. How do teams respond to unexpected changes during PM planning tasks?
2. Are participants exhibiting CF during PM planning tasks?

3. How does implementing zingers in a progressive case affect CF in participants over a semester?
4. Are participants exhibiting PM judgment during PM planning tasks?
5. How does implementing zingers in a progressive case affect PM judgment over a semester?

The inquiry questions outlined in the previous chapter (Table 15) will be answered to support the results of the research questions.

In general, the selected teams approached the zingers differently. In most cases, teams made optimistic assumptions, did not balance constraints, and submitted PM plans with internal inconsistencies. While teams had difficulty executing responses to unexpected changes on their PM plans (low PM J Action, mixed CF Action), they exhibited flexible thinking (very high CF Thought) and an understanding of PM concepts (moderate PM J Thought) in their reflections and discussions. Thus, participants demonstrated more CF than PM judgment, and their *thoughts* exhibited more CF and PM judgment than their *actions*.

Participants

The course was offered by a graduate ID program. There were 15 students in the class, and all but one student was from the ID Master's, advanced certificate, or doctoral program. Thirteen students provided IRB consent (e.g., 13 participants) (Table 16).

A diverse group of students (international/ domestic, race, gender, etc.) enrolls in the ID programs. Since this dissertation study collected only course artifacts and the researcher did not interact with any participants, she did not have information about participants' backgrounds or their demographics. This dissertation study focused on the design of progressive cases and participants' thoughts and actions. Ethnographic descriptions of how participants' characteristics affect their experiences were beyond the scope of this dissertation study.

Table 16

Participant and Team Summary

Participant	IRB Consent for Analysis of Individual Data (Y/ N)	Team Assignment	Selected Team (Y/N)	Accidental PM	PM Prior Experience Notes
Participant 1	Y	A	Y	N	Has experience leading projects as a teacher.
Participant 2	Y	A	Y	Y	
Participant 3	Y	A	Y	Y	Has ad-hoc experience, trial and error
Participant 4	Y	B	Y	Y	
Participant 5	Y	B	Y	N	Experience in ID PM. Has training in PM.
Participant 6	N	B	Y		
Participant 7	Y	C	N		
Participant 8	Y	C	N		
Participant 9	N	C	N		
Participant 10	Y	D	Y	N	Coaching
Participant 11	Y	D	Y	Not provided	Has to lead projects without experience, but will make it work
Participant 12	Y	D	Y	Y	Coaching, in charge of projects but is not an expert
Participant 13	Y	E	N		
Participant 14	Y	E	N		
Participant 15	Y	E	N		

Note. Data that could be traced back to Participant 6 and Participant 9 were excluded from the study because they did not provide IRB consent.

At the beginning of the course, the instructor asked the students to review the case scenarios and provide their first and second choices. It appears that students chose the cases based on the context, for example, the student athletes chose to work on the student athlete case.

Based on their preferences, the students in the class were split into five teams (Teams A-E). The instructor also considered students' backgrounds and interests while assigning the teams. She looked at creating teams consisting of students who were similar to and different from each other. Each team was limited to 2-3 students. The instructor approved all requests to switch teams.

Note, the instructor of the course and an outside reviewer confirmed that the cases scenarios were equivalent in terms of information and difficulty. Thus, differences between the teams are likely not be attributed to the context of the case.

Three teams (Team A, Team B, and Team D) were selected for full data analysis. These teams were selected because they approached the zingers in different ways, resulting in a richer research case. Team C was not selected because the participants marked areas on their PM plans that may change but did not make actual changes. Thus, they did not have any data that could have demonstrated the action aspects of this study.

Eight out of the 13 participants were part of the three selected teams. Four participants from the selected teams had prior PM experience. However, this prior PM experience was very limited and did not seem to involve the five phases of PM. For example, two participants listed "coaching" as prior PM experience, however, coaching does not generally involve balancing the triple constraint and managing interdependent parts. Thus, the participants in the selected teams were assessed as early novices in PM (novices have less than 10 years of experience). The selected teams did not differ from one another in terms of amount of prior PM experience. Thus, differences in their levels of CF and PM judgment cannot be attributed to experience before the course/ research study.

Methodology Review

Concepts

This dissertation study describes the learning process during a progressive case by tracking CF and PM judgment in thought and action dimensions over time. Progressive cases engage learners in *thought and action* by prompting them to respond to project changes. Two unexpected and realistic changes (*zingers*) were presented during the case. The first zinger asked students to add a multimedia element in the instruction by using a new technology. The second zinger reduced the project timeline by 20%.

This dissertation study looked at two types of thinking strategies: CF and PM judgment. Both are needed to adjust one's thinking and plans (e.g., go back and revise completed work), and deliver a successful project when something unexpected happens. CF is demonstrated when participants think flexibly by considering multiple perspectives (Spiro et al., 1988), seeking alternative solutions (M. M. Martin & Rubin, 1995, p. 623), and adjusting their thinking and PM plans to new task demands (Krems, 1995). PM judgment is demonstrated when participants make decisions to protect or balance the triple constraint (Maley, 2012; Project Management Institute, 2004) and manage the interdependent parts of PM plans (Project Management Institute, 2017).

Data Analysis Framework

The data analysis framework outlined in Chapter 3 divides the data into two levels. Level 1 codes track *strong and weak* instances of CF and PM judgment (PM J). The researcher also looked at how participants exhibited CF and PM judgment in their *thoughts and actions*. Level 1 codes were developed by crisscrossing the following: the *two outcomes* (CF, PM J), the *two evaluations* (strong, weak), and the *two modes* (thought, action). Thus, the Level 1 codes in this dissertation study are: Strong CF Thought, Weak CF Thought, Strong CF Action, Weak CF Action, Strong PM J Thought, Weak PM J Thought, Strong PM J Action, and Weak PM J Action.

The Level 1 Thought codes have sub-codes (e.g., Level 2 codes), aligned with best practices and common misconceptions described in Cognitive Flexibility Theory (CFT) and PM models and literature (Table 13, Table 14). Level 2 Thought codes make the research case richer because *types* of flexible thinking and PM judgment can be investigated and tracked separately.

Time-Series Analysis

Time-series analysis was used to track CF and PM judgment over time (Yin, 2018). Changes in CF and PM judgment over the semester can be attributed to the presentation of zingers because of their chronological and contingent relationship. The course was divided into an early and a late phase. The early phase ran from the beginning of the course to the end of zinger 1, and the late phase ran from the presentation of zinger 2 to the end of the course. Thus, all course documents (and the data collected and analyzed from these documents) were categorized as either early or late.

Data Sources

The following data were collected and analyzed in the dissertation study (Table 17). The Cognitive Flexibility Scale, worksheets, and final exam were analyzed for all participants. Other data were only analyzed for the selected teams (ex. recordings of virtual sessions). Participants completed some course activities individually (ex. prior PM experience worksheets). Other activities were done as a team (ex. revision drafts). Missing data were noted; there was sufficient data to identify trends and answer the research questions.

Table 17

Data Sources

Data Source	Individual Data	Team Data	Selected Teams Only	Thought Codes	Action Codes	Missing Data Notes
Prior PM experience worksheets	X		X	N/A	N/A	One student did not provide IRB consent.
Cognitive Flexibility Scale	X			N/A	N/A	One pre-measure and two post-measures.
Revision drafts		X	X		X	One participant did not submit a revision draft individually, but there was a team submission.
Recordings of virtual sessions		X	X	X		One team consisted of a student who did not provide IRB consent. The virtual session could not be analyzed because the student could be identified.
Worksheets	X			X		One student did not submit a worksheet during virtual session 2.
Final exam	X			X		None

Results: Frequencies and Distributions of Level 1 and Level 2 Codes

Data analysis brought about over 1,400 codes (Table 18). Of this, 1,337 codes were within the data analysis framework (e.g., Level 1 and Level 2 codes). The course artifacts had rich codes. For example, in a short portion of the second worksheet (Figure 9) and final exam (Figure 10), all four Level 1 codes are represented.

In the early phase, there were a total of 427 codes. The late phase had more than double the number of codes (983) because the final exam added 379 codes. Also, the recordings of the virtual sessions and the revision drafts for zinger 2 had more codes (176 and 257 respectively) than those for zinger 1 (107 and 131 respectively). This was mainly because the teams were more responsive to zinger 2. For example, there were 28 Strong CF Action codes in the first revision drafts and 170 Strong CF Action codes in the second revision drafts.

Figure 9

Rich Codes in Worksheet 2 (Poor PM J Thought: pink, Strong PM J Thought: green, Strong CF Thought (Change codes): purple, Weak CF Thought: orange)

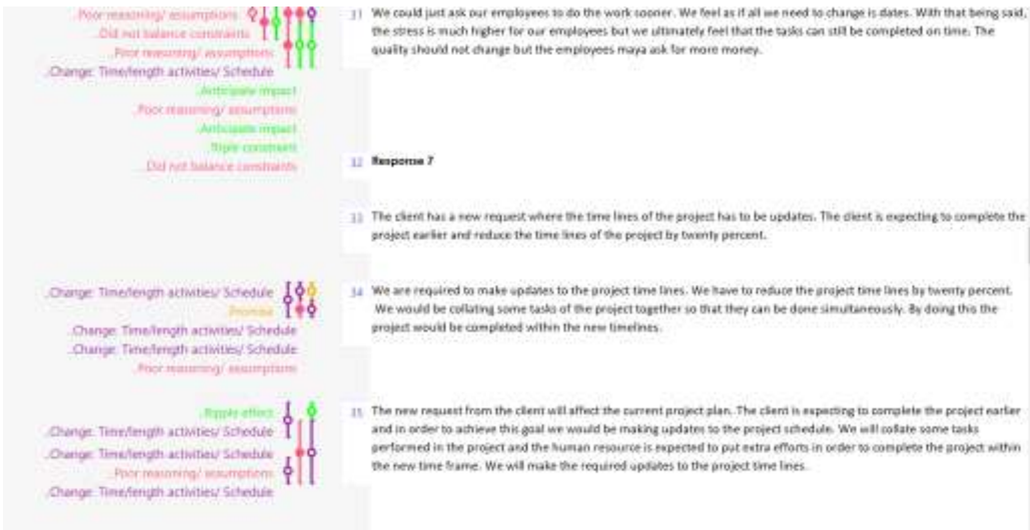
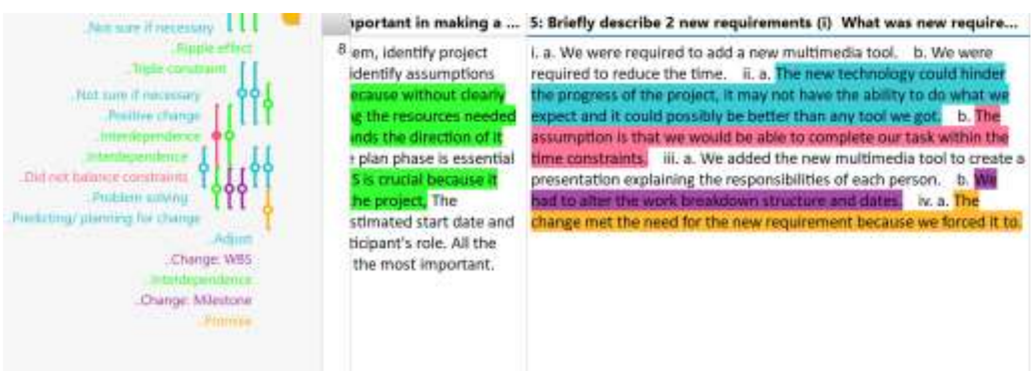


Figure 10

Rich Codes in Final Exam, Participant 10 (Poor PM J Thought: pink, Strong PM J Thought: green, Strong CF Thought (Change codes): purple, Strong CF Thought: teal, Weak CF Thought: orange)



Distribution of Level 1 Codes: Strong and Weak

To investigate the influence of progressive cases, levels of CF and PM judgment were tracked over time by splitting the course (and the data) into two phases, early and late (Table 18). Since more data were collected later in the course, the frequencies should not be compared when answering the research questions. Rather, the percentage of Strong and Weak codes were calculated overall and for each phase by using the following equations:

$$\%\ of\ \boldsymbol{Strong}\ Level\ 1\ Code = \frac{Frequency\ of\ \boldsymbol{Strong}\ Level\ 1\ Code}{Frequency\ of\ \boldsymbol{Total}\ \ Level\ 1\ Codes}$$

$$\%\ of\ \boldsymbol{Weak}\ Level\ 1\ Code = \frac{Frequency\ of\ \boldsymbol{Weak}\ Level\ 1\ Code}{Frequency\ of\ \boldsymbol{Total}\ Level\ 1\ Codes}$$

Thus, the percentage of Strong Level 1 and percentage of Weak Level 1 within each phase sum up to 100%. For example, the percentages of Strong PM J Thought and Weak PM J Thought from columns D and E in Table 18 sum up to 100% (ex. 73% and 27% in the early phase). To simplify the results, sometimes only Strong percentages are reported when comparing levels of CF and PM judgment over time. Weak percentages can be calculated by subtracting the Strong percentage from 100%.

Level 1 Thought Codes

Participants' thoughts were recorded in the worksheets, virtual sessions, and the final exam (Table 17). These documents were coded using CF Thought and PM J Thought codes.

There were a total of 949 Level 1 Thought Codes. Strong CF Thought had the highest frequency (483) which equates to 51% of the total, followed by Strong PM J Thought (272, 29%), Weak PM J Thought (158, 17%), and Weak CF Thought (36, 4%) (Table 19). Note, the percentages reported in the table sum to approximately 100%; any deviation is due to rounding. The percentages of Level 1 Thought codes changed over time (Figure 11). Strong CF Thought remained very high (above 90%) throughout the course. Strong PM Thought decreased slightly from the early phase (73%) to the late phase (60%) (Figure 12).

Table 18

Level 1 Code Distribution within Data Sources and by Phase

	Column→	A	B	C	D	E	F	G	H	I
	Data Source	Total Codes*	Strong CF Thought	Weak CF Thought	Strong PM J Thought	Weak PM J Thought	Strong CF Action	Weak CF Action	Strong PM J Action	Weak PM J Action
Overall	TOTAL	1,410	483	36	272	158	198	91	40	59
Overall	Distribution Between Strong and Weak Overall	NA	93%	7%	63%	37%	69%	31%	40%	60%
Early Phase	Worksheet 1	189	100	6	56	26	0	0	0	0
Early Phase	Recordings of Virtual Session 1	107	70	5	23	3	0	0	0	0
Early Phase	Revision Draft 1	131	0	0	0	0	28	50	21	32
Early Phase	Early Totals	427	170	11	79	29	28	50	21	32
Early Phase	Early Distribution Between Strong and Weak	NA	94%	6%	73%	27%	36%	64%	40%	60%
Late Phase	Worksheet 2	171	83	1	45	39	0	0	0	0
Late Phase	Recordings of Virtual Session 2	176	73	13	25	58	0	0	0	0
Late Phase	Revision Draft 2	257	0	0	0	0	170	41	19	27
Late Phase	Final exam	379	157	11	123	32	0	0	0	0
Late Phase	Late Totals	983	313	25	193	129	170	41	19	27
Late Phase	Late Distribution Between Strong and Weak	NA	93%	7%	60%	40%	81%	19%	41%	59%

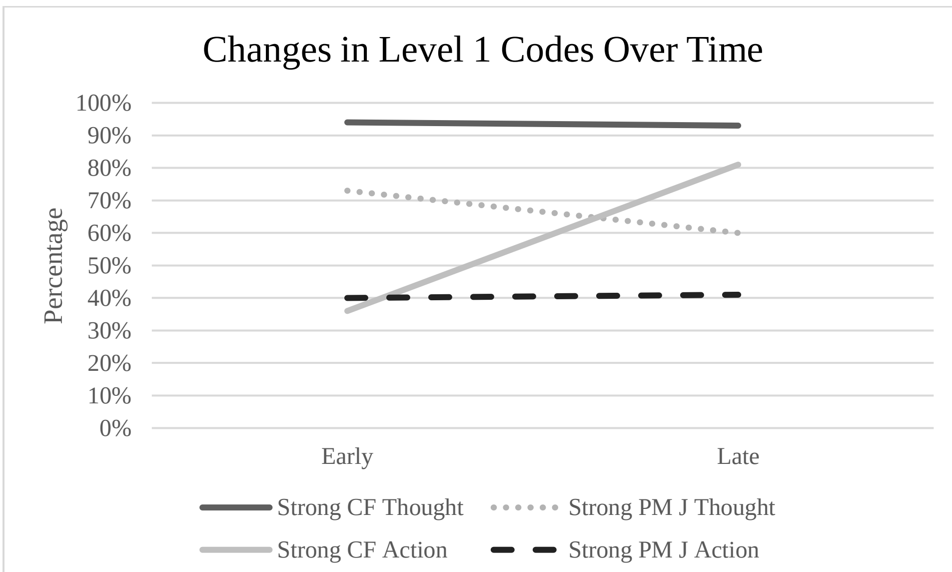
Table 19

Frequencies and Percentages of Level 1 Thought Codes

Level 1 Thought Codes	Frequency	Percent of Level 1 Thought Codes
Strong CF Thought	483	51%
Weak CF Thought	36	4%
Strong PM J Thought	272	29%
Weak PM J Thought	158	17%
Total	949	100%

Figure 11

Changes in Level 1 Codes over Time



Level 1 Action Codes

The participants' *execution* of CF and PM judgment were recorded in the revision drafts of their PM plans. These *actions* were coded with one of the CF Action and PM J Action codes. There were a total of 388 Level 1 Action Codes (Table 20). Strong CF Action had the highest frequency (198, 51%), followed by Weak CF Action (91, 23%), Weak PM J Action (59, 15%), and Strong PM Action (40, 10%)

Table 20

Frequencies and Percentages of Level 1 Action Codes

Level 1 Action Codes	Frequency	Percent of Level 1 Action Codes
Strong CF Action	198	51%
Weak CF Action	91	23%
Strong PM J Action	40	10%
Weak PM J Action	59	15%
Total	388	100%

Table 20 and Figure 11 display how the percentages of Level 1 Action codes changed over time. Strong CF Action increased dramatically (from 36% to 81%). Strong PM Action remained moderate throughout the course (approximately 40%) (Figure 13). Participants executed more revisions late in the semester (CF Action); however, only a portion of revisions reflected good PM practice (PM J Action).

Figure 12

Summary of the Results by Level 1 Thought Code

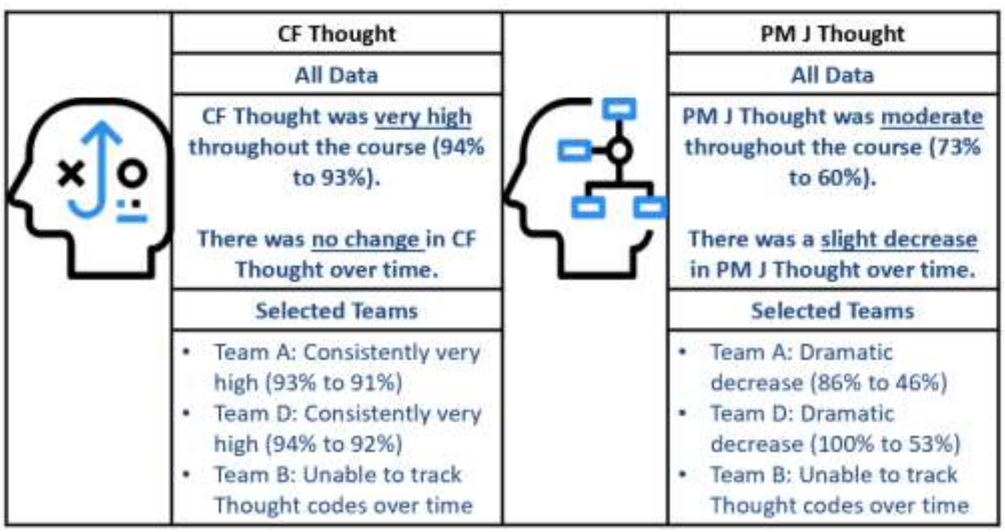
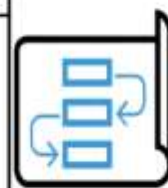


Figure 13

Summary of the Results by Level 1 Action Code

	CF Action		PM J Action
	All Data		All Data
	CF Action increased dramatically over time from 36% to 81%.		PM J Action was low throughout the course (40% to 41%). There was no change in PM J Action over time.
	Selected Teams		Selected Teams
	• Team A: Slight increase (60% to 77%) • Team D: Slight decrease (40% to 17%) • Team B: Dramatic increase (0% to 90%)		• Team A: Decrease (72% to 41%) • Team D: Dramatic increase (0% to 62%) • Team B: Consistently low (0% to 0%)

Research Questions

Research Question 1: How do teams respond to unexpected changes during PM planning tasks? Each team responded differently.

The results of Research Question 1 (RQ 1) are based on the themes and patterns found in the following data sources: virtual sessions, revision drafts, and final exam. The discussions during the virtual sessions gave insight on individuals' *initial* reactions to the zingers. The revision drafts and final exam reflected the teams' *decisions and their execution*. This research question is answered with a mixture of individual and team level data. While the PM plans were developed and submitted as a team, individuals' reactions to the zinger were analyzed by reviewing the virtual sessions and final exams. (Note, the CF instrument and worksheets were anonymous, and could not be traced back to a participant or team. The course survey instruments were only graded as complete/ incomplete and maintained anonymity to encourage honesty. Thus, data from these sources could not be used to answer this research question.)

To answer RQ 1, the percentages of each team's Strong Level 1 codes will be discussed (Table 21). To support the quantitative analysis, the teams' initial reactions and execution on their PM plans will be described with qualitative examples.

Percentages of Strong Level 1 Codes by Team (Quantitative Analysis)

Each team was given a name that synthesizes the *thoughts and actions* captured in the data. Team A (*Many Changes*) responded to zinger 1 by making many, consistent changes throughout their PM plan. The percentages of Strong Level 1 codes support these observations. They had high levels of Strong CF Thought throughout the course (93% and 91%); and their Strong CF Action slightly increased (60% to 77%) over time. However, they exhibited some poor PM judgment when responding to zinger 2. Their Strong PM J Thought (86% to 46%) and Strong PM J Action (72% to 41%) *dramatically decreased* from the early phase to the late phase.

Throughout the course, Team A's Strong Thought codes were higher than their Strong Action codes. Thus, Team A was thinking flexibly and with varied levels of PM judgment, but did not execute this thinking as well on their PM plans.

Team D (*Minimize Impact and Slack*) responded to zinger 1 by *minimizing the effect* of the zinger. This required flexible thought and a type of PM judgment, *progressive elaboration.* This is supported by high levels of Strong CF Thought (94%) and Strong PM J Thought (100%) in the early phase. However, their first revision draft had few edits, imbalanced constraints, and inconsistencies— reflected by low levels of Strong CF Action (40%) and Strong PM J Action (0%) (Table 21). In response to zinger 2, the team decided to use slack to reduce the project timeline. While using *contingency* is a type of good PM judgment, the team also made some optimistic assumptions, resulting in a *dramatic decrease* in Strong PM J Thought (100% to

53%). Over time, Strong CF Action decreased (40% to 17%) and Strong PM J Action increased (0% to 62%). This reflects the *types* of edits the team made on their PM plans.

When responding to zinger 1, Team B (*Avoidance and Weak Response)* assumed that the new technology requirement did not affect their project deliverable. Thus, they did not make any edits to their PM plan in the early phase resulting in low levels of Strong CF Action and Strong PM J Action (0%) (Table 21). When the project timeline was shortened with zinger 2, Team B made many changes to their PM plan, resulting in a high level of Strong CF Action (90%). However, they did not balance constraints and made optimistic assumptions; Strong PM J Action remained low (0%).

Table 21

Team A, D, and B's Early and Late Strong Level 1 Codes: Frequencies and Percentages

	Team A: Many Changes		Team D: Minimize Impact and Slack		Team B: Avoidance and Weak Response	
	Early	Late	Early	Late	Early	Late
Strong CF Thought	55 (93%)	109 (91%)	15 (94%)	49 (92%)	Thought Data Not Available By Phase	
Strong PM J Thought	18 (86%)	48 (46%)	5 (100%)	26 (53%)		
Strong CF Action	9 (60%)	62 (77%)	19 (40%)	2 (17%)	0 (0%)	106 (90%)
Strong PM J Action	21 (72%)	11 **(**41%)	0 (0%)	8 (62%)	0 (0%)	0 (0%)
Summary	• <u>No change</u> in Strong CF Thought, <u>high</u> throughout the course (93% to 91%) • <u>Dramatic decrease</u> in Strong PM J Thought (86% to 46%) • <u>Slight increase</u> in Strong CF Action (60% to 77%) • <u>Decrease</u> in Strong PM J Action (72% to 41%)		• <u>No change</u> in Strong CF Thought, <u>high</u> throughout the course (94% to 92%) • <u>Dramatic decrease</u> in Strong PM J Thought (100% to 53%) • <u>Slight decrease</u> in Strong CF Action (40% to 17%) • <u>Dramatic increase</u> in Strong PM J Action (0% to 62%)		• Unable to track Thought codes over time • <u>Dramatic increase</u> in Strong CF Action (0% to 90%) • Strong PM J Action was consistently low (0% in early and late phase)	

Initial Responses and Execution (Qualitative Analysis)

Team A: Many Changes. Three participants were in Team A (Table 16). Only one participant had PM experience. Team A was tasked to prepare a PM plan for converting face-to-face chemistry classes to online classes in a higher education context.

Team A: Initial Response to the Zinger 1 (Virtual Session 1). At the beginning of the virtual session, two out of three of the participants were unsure about what the zinger was asking of them. To clarify the activity, Team A made assumptions about the type of technology that the client wanted to add. Options such as a collaborative, bulletin board app (Padlet) and PowerPoint were discussed. Once they had a common frame of reference, they discussed how adding a new multimedia deliverable would affect their PM plan in areas such as: Work Breakdown Structure (WBS), training process, project activities, and Critical Path.

Their discussion demonstrated understanding of *interdependent parts*, a type of PM judgment. For example, they considered how the WBS is related to the Critical Path. When describing their proposed response to the zinger, one participant said:

> Everywhere. From budget to human resources to critical path to skill set of the people. Everywhere. *(Team A, Virtual Session 1)*

They also tried to *minimize the effect* of the zinger, a type of Strong PM judgment. One participant suggested delaying the implementation of the multimedia tool to the next cycle.

This team debriefed with the instructor after submitting their worksheets. The first question the instructor asked was what their response would have been to the client. Responses included:

> *Quote 1*: I will not do it. You [client] should tell me earlier. *(Team A, Virtual Session 1)*
>
> *Quote 2:* In my heart I would say, “What the hell?” but I will have to do it. *(Team A, Virtual Session 1)*
>
> *Quote 3:* I have no choice. *(Team A, Virtual Session 1)*

These responses were instances of Weak CF Thought. The first quote demonstrates a lack of flexibility (coded as not capable of change). The second and third quotes are examples of promising the client that they can accommodate the change request (coded as promise).

Then, the instructor asked the participants what questions they would ask the client. One response was:

> How do you know that…the new multimedia element would enhance the learning of the students? *(Team A, Virtual Session 1)*

This participant also suggested conducting a survey to see if people were interested in using the software. These are examples of Strong CF Thought because the participant questioned whether the scope change request is necessary, instead of blindly accepting the client's perspective.

One participant asked if the client was going to give them more money. The instructor responded, "No.". The participant's question demonstrates understanding of the *triple constraint*, a type of Strong PM judgment. However, the participant accepted this answer without explaining to the client why additional resources are necessary or negotiating a tradeoff to keep constraints balanced. While the question demonstrated Strong PM J Thought, the acceptance of the client's denial of additional funds is an example of Weak PM J Thought. The participant made an optimistic assumption that they could accommodate the scope increase without additional resources.

CF involves considering multiple solutions (M. M. Martin & Rubin, 1995). As another measure of CF, the number of options and/or implications that the team discussed during the virtual session can be analyzed and compared. Table 22 contains a list of all change: X codes in virtual session 1 and 2 by team. In virtual session 1, Team A mentioned options and implications 51 times, in 12 unique categories including the design of the training, critical path, and project goals. This provides additional support that Team A was thinking flexibly.

Team A: Execution of Response to Zinger 1. Team A responded to zinger 1 by making many, consistent changes in their PM plan to accommodate the use of the new technology. The following areas were edited: objectives, success criteria, assumptions and risks, WBS, activity times and sequencing (Figure 14), critical path, work packages, and job descriptions (Figure 15). While the edits were consistent, the constraints were imbalanced because they did not allocate additional time or budget to cover the scope change.

Figure 14

Sample of Additional Project Activity and Sequencing (Revision highlighted in green.) (Revision Draft 1, Post Zinger 1, Team A)

2.5	**Upload 15 concept graphics and develop separate podcasts and discussion threads to facilitate discussion**	2.4	2.1	4	14	July 29	August 1
2.5.1.	Design instructions for discussion boards				14		
2.5.2.	Create discussion boards and threads				14		
2.5.3.	Upload concept graphics in the discussion board				14		
2.6	**Creating Padlet (online bulletin board) post-laboratory sessions to engage them in reflective exercise after the class.**	2.1	3.6	3	17	August 6	August 8
3	Evaluate the project efficacy formatively and summatively				14		
3.1	**Design a survey asking students' and faculty to self-report the improvement in their skills, post- training**	1.2	3.3	5	3	May 3	May 9

Figure 15

Sample Strong PM J Action Code: Revision in Job Description (Revision Draft 1, Post Zinger 1, Team A)

Instructional designer	• Degree/experiences (5+ years online/F2F,) • Design expertise (design theory to practice, writing, message design, assessment, etc.) • Communication skills (writing, oral, graphic/visual, interviewing, negotiation, etc.) • Technical skills (instructional design software and web technologies (online bulletin boards quizlet, etc.), effective communication with graphics, create media to support learning such as visual aids and various multimedia for online learning)
Job Title	Criteria

Team A: Initial Response to the Zinger 2 (Virtual Session 2). Team A's initial reaction to zinger 2 was that they expected that there would be more changes to the project. They seemed to understand that unexpected events and change requests will come up during projects.

Table 22

Change Codes in Virtual Sessions by Team

Code	Frequency			
	Team A Virtual Session 1	Team A Virtual Session 2	Team D Virtual Session 1	Team D Virtual Session 2
Change: Activities (may be additional)	6			
Change: Assumptions	2			
Change: Cost	2	1		
Change: Critical path	10			
Change: Design of training	11	1	4	
Change: Goals	5		2	
Change: Job Description	2			
Change: Meetings			2	
Change: Resources			1	
Change: Staff (may be add)	1	37		3
Change: Staff contracts		3		
Change: Support	1			
Change: Time/ length activities/ Schedule	5			12
Change: Train staff	3		1	
Change: WBS	3			1
Change: Work assignments		6	1	
Total unique options/ implications discussed	12	5	7	3
Total options/ implications discussed	51	48	12	16

Note: No data available for Team B

They had difficulty deciding how to respond to zinger 2. During the virtual session, they considered many revisions such as: making the project team work harder, adding staff, changing the design of the project deliverable (e.g., the instruction), revising staff contracts, and reassigning project tasks (Table 22). In virtual session 2, Team A considered options and/or implications 48 times. However, that consisted of only five unique options and/or implications. Compared to 12 alternatives in the early phase (Table 22), Team A considered fewer alternative solutions in the late phase of the course. Yet, their levels of Strong CF Thought remained high (91%).

Team A demonstrated Strong PM judgment during the virtual session. For example, they discussed the *triple constraint* and acknowledged that they could not make people work harder. They also demonstrated an understanding of *interdependent parts*, realizing that they would need to adjust multiple parts of their plan, such as their Gantt chart.

However, there were instances of Weak PM J Thought. Team A made some optimistic assumptions, like cost is not an issue for the client. This led them to consider hiring more people to work on the project or increasing some of the project team's billable hours. They finally decided to hire Teaching Assistants (TAs) to the project team and rearrange some project activities to people who have time (*optimizing schedule*). The team made an optimistic assumption that the new hires would have the knowledge and skills to support the development of instruction. These optimistic assumptions are common misconceptions/ errors in PM (Table 9) and contributed to the decrease in Strong PM J Thought in the late phase (86% to 46%) (Table 21).

Team A: Execution of Response to Zinger 2. Team A made many edits to their estimated times and start dates (Figure 16) to shorten the project timeline. This is reflected in an increase in Strong CF Action in the late phase (60% to 77%). However, the team did not make consistent changes and did not balance constraints, contributing to a decrease in PM J Action (72% in the early phase to 41% in the late phase).

For example, in Figure 17, Weak PM Action was coded four times for the following reasons:

1. Dates were not changed to reflect the new project duration.

2. Training mentioned for “teacher and students” but did not include new hires.
3. Poor reasoning about time and cost.
4. Did not consider the cost of new hires.

Figure 16

Sample of Revisions to Start Time and Durations (Revisions highlighted in blue.) (Revision Draft 2, Post Zinger 2, Team A)

Activity No.	Activity Description	Sequence relationships		Estimated Time / Start	
		before	after	days	period
1	Provide face to face training to both students and faculty prior to the start of the academic year				
1.1	Draft a project timeline	Start	1.2	1	1
1.2	Setup a meeting with Department Chair and Chemistry Professors	1.2	1.1	1	1
1.3	Develop a training session plan	1.2	3.3	10	3
1.4	Implement the training for students and faculty	3.3	3.5	13	4
2	Support faculty to create resources for online learning				
2.1	Develop tutorials for navigating through online courses	2.5	3.6	3	4
2.2	Create 3 course syllabi with hyperlinks	3.5	2.4	6	1
2.3	Record and upload 45 demonstration videos showing chemical reactions	3.5	2.4	16	4
2.4	Create 60 E-learning modules having lectures and pop quizzes for each	2.2,2.3	2.5	19	8
2.5	Upload 15 concept graphics and develop separate podcasts and discussion threads to facilitate discussion	2.4	2.1	3	13
2.6	Create 15 Online bulletin boards to facilitate reflective exercise for the laboratory sessions.	3.6	2.1	10	17
3	Evaluate the project efficacy formatively and summatively				
3.1	Design a survey asking students' and faculty to self-report the improvement in their skills, post- training	1.2	3.3		6

Team D: Minimize impact and slack. Team D consisted of three participants (Table 16). Two of the participants had PM experience in the context of coaching athletic teams. The third participant reported leading projects without experience. Team D’s case was related to providing instruction on time management skills to athletes in a higher education setting.

Figure 17

Example of Weak PM J Action Revision Draft 2, Post Zinger 2, Project Proposal, Team A

Project Proposal

Project Name: Converting Face-To-Face Chemistry Classes to Online						Starting date: May 1
Activity		Schedule	Budget			Time
Name	Description:	Start-End	$	Labor	Materials	
Training	Provide training for teacher and students	May 1- June 6 21 days	500	Salaries*	Presentation materials, digital classroom, and refreshments	4 hours a day 84 hours in total
Creating Online resources	Support faculty to create resources for online learning	June 11 - August 6 50 days	1000	Salaries	Scanner, laptops, computer software, camera.	4 hours a day 200 hours in total
Evaluation	Evaluate the project efficacy formatively and summatively	May 3 – August 27 116 days	1000	Salaries	Online software for survey	Half hour a day 58 hours in total
*Since all the staff is employed by the university, therefore, we won't pay them additional salaries to work specially on this project. Their salaries will come from university budget.						

Team D: Initial Response to the Zinger 1 (Virtual Session 1). Team D's discussion during the virtual session began with identifying the parts of the PM plan that would need to be edited, including the WBS and goals.

Also, like Team A, Team D made assumptions about what type of technology would be added to their project. After considering Visio (diagraming software) and a mobile application, they chose PowerPoint. Once the team agreed on the technology and their approach, one participant said,

> I think that was supposed to be a curve ball, but we were [inaudible] on it. (*Team D, Virtual Session 1)*

Overall, Team D had a positive attitude in response to the zinger, deciding to minimize the effect as much as possible. They used *progressive elaboration* to add details to their existing activities. Progressive elaboration, a type of PM judgment, entails developing broad plans early in the project and making them more detailed as objectives and deliverables are clarified (Project Management Institute, 2004).

They acknowledged that the new multimedia tool may have impressed the client because it may perform better than other tools. This was an unexpected response to the zinger and was coded as positive change under Strong CF Thought.

Team D's discussion was much shorter since their approach mostly involved progressive elaboration of project activities. Team D only discussed options and/or implications 12 times (Table 21). This is much lower than Team A, who discussed options and/or implications 51 times during virtual session 1. Yet, the teams' levels of Strong CF Thought were very close in the early and late phase (all over 90%) (Table 21).

Like Team A, after Team D submitted their worksheets, the instructor asked how they would respond to the client. One participant demonstrated understanding of the triple constraint:

> Adding a new resource, a new tool, will impact the quality your time because I mean it takes time for everybody to learn how to use this new resource, whatever it is, this new technology, so that is how I would respond to him, like, this gonna affect the timeline, everything. (Team D, Virtual Session 1)

Team D: Execution of Response to Zinger 1. Team D minimized the effect of the zinger 1 by adding details to existing activities (Figure 18). In other words, they did not increase the scope of their project by using progressive elaboration and late-locking to accommodate the new technology (Olsson, 2006). Like Team A, Team D had difficulty executing their flexible thinking and PM judgment on their PM plans. On their first revision draft, they made few edits and did not balance constraints. Their PM plan also had inconsistencies. This resulted in lower Strong CF Action (40%) and Strong PM J Action (0%) levels in the early phase.

Figure 18

Sample Minimizing Revisions in a PM Plan (Revisions in orange font.) (Revision Draft 1, Post Zinger 1, Team D, Participant 12)

Plan

Work Breakdown Structure

Activity Characteristics Legend:

1-Status/completion measurable; 2-Clear start/end date event; 3-Time/cost easily estimated; 4-Managable/measureable/integratable/independent

Activity No.	Activity Description	Characteristics			
		1	2	3	4
1.1	Send out reminder email about logistics session on January 1				
1.2	Create New Multimedia Technology outlining project management plan				
1.3	Hand out list to staff of semester expectations for students				
1.4	Explain to head coach / assistant coach their individual responsibilities for the program				
2.1	Create New Multimedia Technology outlining examples of motivational marketing strategies				
2.2	Give individualized expectations of using the New Multimedia Technology to instructional designers, program evaluation specialists, videographers, graphic artists, educational technology/programmers, and educational project manager				

Team D: Initial Response to the Zinger 2 (Virtual Session 2). One participant's initial response to the shortened project timeline was that more people were needed. This was like Team A's response to zinger 2. The other two participants on the team disagreed with this assumption. One participant said:

> We had too much time. *(Virtual Session 2, Team D)*

After further discussion, Team D noticed that they had overestimated how long project activities would take. They decided to use their *contingency* to respond to the zinger. Building flexibility (Guldemond et al., 2008) and slack (Harrin, 2013) in a project are PM best practice (Table 9) and were coded as Strong PM J Thought.

Team D decided to change the dates and length of project activities to deliver the project earlier (Table 22). This represented 12 out of the 16 instances they discussed options and/or implications. Since they were using contingency, they did not adjust other constraints, such as scope or quality. Therefore, Team D only discussed three unique options and/or implications during this virtual session.

Team D discussed whether to charge the client more for delivering the project quicker. This demonstrates an understanding of the *triple constraint*. However, the team decided not to do that. This final decision was an example of Weak PM J Thought because it was based on a poor assumption (and is one of the common misconceptions/ errors in PM (Table 9)). Weak PM J Thought was also coded when they made optimistic assumptions that they could finish deliverables, such as videos, in a shorter time frame. This reasoning was apparent in the team's final exams:

> *Quote 1*: Our assumptions about the project was [sic] that we did not need to change anything we just needed to demand things sooner from our project team. (*Final Exam, Participant 11, Team D*)

> *Quote 2:* We needed our stuff done sooner so our work packages were shortened but the work load was not changed at all. (*Final Exam, Participant 11, Team D*)

At the end of the second virtual session, Team D reflected on the first zinger. They discussed that they assumed that it was non-negotiable. This assumption is an example of Weak CF Thought because they accepted the client's point of view without considering alternative solutions. They reflected that they could have questioned whether they had to use it or if they could hire people who already knew how to use it.

In summary, there were times when Team D exhibited flexible thinking and PM judgment; however, they dismissed these ideas very quickly. Thus, these ideas could not be executed on their PM plans.

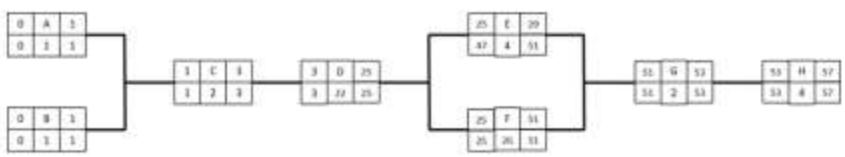
Team D: Execution of Response to Zinger 2. For zinger 2, Team D made edits to multiple parts of the PM plan, with some inconsistencies (Figure 19). For example, in the Critical Path, Team D changed the duration of four activities (four codes of Strong CF Action) but did not remove activities or add resources to balance constraints (one code of Weak PM J Action).

Figure 19

Sample Response to Zinger 2 (Revisions in orange font.) (Revision Draft 2, Post Zinger 2, Team D)

Critical Path

	Activity	Predecessor	Duration (Weeks)
A	Logistics Session 1 – Coaches and Athletic Staff	-	1
B	Logistics Session 2 – Instructional Design Team	-	1
C	Project Development Begins	A,B	2
D	Complete Instructional Resources	C	19
E	Training Session for Academic Counselors	D	3
F	Training Session for Jr. and Sr. Student Athletes	D	23
G	Create Sessions for Last Two Weeks of Summer	E,F	2
H	Conduct Follow Up Meeting	G	3



Critical Path: A-B-C-D-F-G-H = 57 Weeks

The slight decrease in Strong CF Action (40% to 17%) and dramatic increase in Strong PM J Action (0% to 62%) are mostly due to a difference in the types of edits Team D made. In response to zinger 1, most edits were primary to the zinger constraint and were coded as Strong CF Action. In response to zinger 2, edits were made in the Goal, Success Criteria, and Critical Path. These edits were coded as Strong PM J Action since they require rippling change throughout the PM plan.

Team B: Avoidance and weak response. There were three students in Team B (Table 16). Only two students provided IRB consent. Thus, no data that could be linked to directly to this student could be analyzed, including the virtual sessions. One participant had no PM experience and the other had PM training and experience managing in an ID context. Team B's case involved coordinating IDs' work at a company that designs instruction for clients. They were tasked to write a PM plan for the development of standardized templates for different course formats.

Team B: Execution of Response to Zinger 1. In response to zinger 1, Team B assumed that the new multimedia element did not affect the project deliverable because the IDs (e.g., the users of the templates) could use any technology to develop their instruction.

> *Quote 1*: We did not make any major changes to our project management plan for this requirement. (*Final Exam, Participant 5, Team B*)
>
> *Quote 2*: this [sic] common templates [sic] followed the ADDIE model and irrespective of the technology platform used. (Final Exam, Participant 5, Team B)

This was a poor assumption; the client representative told the team that the new technology needed to be incorporated *into the project deliverable* (e.g., the technology would be used to develop the *template*). This poor assumption allowed the team to completely avoid (e.g., ignore) the first zinger. Thus, Strong CF Action and Strong PM J Action were 0% in the early phase (Table 21).

Team B: Execution of Response to Zinger 2. To shorten the project timeline, Team B decided to run the last project tasks simultaneously (Figure 20). The team made many changes to their project's timeline, resulting in a high Strong CF Action level (90%).

> We made various updates to the project management plan to fulfill this requirement (*Participant 5, Team B, Final Exam*)

However, they did not balance constraints and were optimistic that the project team would work harder, resulting in a low level of Strong PM J Action (0%). In summary, Team B responded to zinger 2 by making edits related to the time constraint but did not consider the triple constraint or interdependent parts (components of PM judgment).

Research Question 2: Are participants exhibiting CF in PM planning tasks?

Based on quantitative and qualitative measures, participants were thinking flexibly (CF) throughout the course (Table 23). However, in the early phase of the course they were not *executing* flexible thought on their PM plans. This improved in the late phase; Strong CF Action dramatically increased by over 100%.

Figure 20

Sample Edits (highlighted in green) to Gantt Chart (Revision Draft 2, Post Zinger 2, Team B)

Finalize templates for instructor-led	Mar 12	2	Mar 13
Finalize templates for instructor facilitated	Mar 14	1.5	Mar 15
Finalize templates for self-study	Mar 15	1.5	Mar 16
Create schedule and timesheets	Mar 17	3.25	Mar20
Instructional Designers and Developers	Mar 17		Mar 17
Technical writers	Mar 17		Mar 17
Technology/e-learning specialists	Mar 17		Mar 17

CONTROL PHASE
Schedule/Gantt Charts and Status/Variance Reports

Programmers	Mar 17		Mar 17
Graphic artists	Mar 18		Mar 18
Message design specialists	Mar 18		Mar 18
Videographers	Mar 18		Mar 18
Program evaluation analysts	Mar 18		Mar 18
Assessment analysts	Mar 19		Mar 19
Educational Project Manager	Mar 19		Mar 19
Facilities site coordinators	Mar 19		Mar 19
Expert Trainers	Mar 19		Mar 19
Client trainers and self-study advisors	Mar 20		Mar 20
Collate timesheets	Mar 20	0.75	Mar 20
Finalize timesheets	Mar 21	1	Mar 21

Inquiry Questions

Yin (2018) stated that there are different levels of questions in the case study research method (CSRM). One type of question describes the line of inquiry "to remind [the researcher] of the data to be collected, and why" (Yin, 2018, p. 99). To provide richer results for research questions 2-5, inquiry questions were investigated (Table 15). The results of research question 2's inquiry questions follow (Table 23).

Table 23

Research Question 2 Results

Research Question	Results	
Research Question 2: Are participants exhibiting CF in PM planning tasks?	**Early Strong CF Thought:** 94%	**Late Strong CF Thought:** 93%
	Early Strong CF Action: 36%	**Late Strong CF Action:** 81%
Inquiry Questions	**Results**	
Inquiry Question 2.1: Final exam: Do participants discuss how PMs need to be flexible, adapt tools or techniques, and/or respond to changes? *(Post measure)*	157 Strong CF Thought codes, 11 Weak CF Thought codes. 94% of CF Thought codes in the final exam are Strong.	
Inquiry Question 2.2.: Cognitive Flexibility Scale responses: What are the levels of participants' CF? (*Pre and post measures*)	Pre-measure (average): 4.56 (out of a 6-point scale) Post-measure (average): 4.75 (out of a 6-point scale)	
Based on quantitative and qualitative measures, participants were thinking flexibly throughout the course, but had difficulty executing in the early phase. On their final exams, some participants discussed how PMs need to be flexible and respond to unexpected changes.		

Inquiry Question 2.1: On the final exam, do participants discuss how PMs need to be flexible, adapt tools or techniques, and/or respond to changes?

There were many Strong CF Thought codes in the final exam (157, 94%) and very few Weak CF Thought codes (11, 6%). Two themes related to CF emerged from the final exam. Participants talked about how *PMs need to be flexible* and *respond to changes*. The following are some examples of these themes:

- *PMs need to be flexible*:

> *Quote 1:* Lastly, the project management plan made me realize that flexibility is a vital characteristic of a project manager. Flexibility means the project manager can assign works reasonably, deals with unexpected situations well and change the initial plan according to those unexpected circumstances. Since the project will not be implemented 100 percent according to the original plan, the project manager should adjust their plan to make sure the project can be finished on time. *(Final Exam, Participant 2)*

Quote 2: Project managers are problem solvers. There will be problems during a project. There has never been a project that has gone just as planned. People may leave the project, people you rely on may not complete their task on time or as a whole. Good project managers will handle problems and help the project continue on the right path. *(Final Exam, Participant 11)*

- *PMs need to respond to changes*

Quote 1: In a process of project completion, many hurdles come up so the manager has to resolve all problems *(Final Exam, Participant 1)*

Quote 2: No matter how delicate and careful he [sic] projects are planned, there will always have some circumstances and events could not be foreseen or controlled. *(Final Exam, Participant 2)*

Quote 3: A project manager must plan for the future event [sic] and anticipate any problems that may arise and have responses for them. *(Final Exam, Participant 10)*

Inquiry Question 2.2: What are the levels of participants' CF on the Cognitive Flexibility Instrument?

The quantitative measures of CF were high throughout the course. The average pre-measure and post-measure on the Cognitive Flexibility Scale were 4.59 and 4.75 (out of 6) respectively (Table 23).

Research Question 3: How does implementing zingers in a progressive case affect CF in participants over a semester?

Participants had high Strong CF Thought throughout the course; they were thinking flexibly. However, the participants were executing more flexible thought (e.g., exhibiting *more flexible actions* on PM plans*)* during the late phase.

Inquiry Question 3.1: What is the percentage of Strong CF Action in response to zinger 1? Zinger 2?

Participants made many more revisions in their PM plans in response to zinger 2. In the early phase, 36% of CF Action codes were Strong (Table 24). In the late phase, 81% of CF

Action codes were Strong. Strong CF Action increased dramatically (over double) over the semester.

Table 24

Research Question 3 Results

Research Question	Result
Research Question 3: How does implementing zingers in a progressive case affect CF in participants over a semester?	See inquiry questions.
Inquiry Questions	Results
Inquiry Question 3.1: PM plan drafts: What is the percentage of Strong CF Action in response to zinger 1? Zinger 2? *(Time series)*	• 36% (Early), Frequency: 28/78 • 81% (Late), Frequency: 170/211 • **Dramatic increase (over double)**
Inquiry Question 3.2: What was the percentage of Strong CF Thought in early phases? Late phases? *(Time series)*	• 94% (Early), Frequency: 170/181 • 93% (Late), Frequency: 313/338 • **Consistently high (no change)**
Inquiry Question 3.3: Cognitive Flexibility Scale responses: Do participants report having higher CF after experiencing zingers in the case study? *(Pre-post comparison)*	• Pre-measure: 4.56 (out of a 6-point scale) • Post-measure: 4.75 (out of a 6-point scale) • **Consistently high (no change)**

Based on quantitative and qualitative measures, participants' levels of CF Thought were consistently high throughout the course. Thus, they were thinking flexibly. Their execution of flexible thought increased dramatically at the end of the course.

Inquiry Question 3.2: What was the percentage of Strong CF Thought in early phases? Late phases?

Participants had high levels of Strong CF Thought in both phases (over 90%), so there was no change (Table 24).

Inquiry Question 3.3: Based on the Cognitive Flexibility Scale, do participants report having higher CF after experiencing zingers in the case study?

The participants' average pre-measure on the Cognitive Flexibility Scale (4.56) was very close to the average post-measure (4.7) (Table 24). This is consistent with the results of Inquiry Question 3.2. The quantitative and qualitative data suggest that participants were thinking flexibly throughout the semester.

Research Question 4: Are participants exhibiting PM judgment during PM planning tasks?

Strong PM J Thought was moderate in both phases (73% and 60%) and Strong PM J Action was consistently low (40% and 41%) (Table 25). Participants learned important PM concepts during the course, but had difficulty executing these concepts on their PM plans. As discussed in the RQ 1 results, most PM plans were inconsistent, and the teams did not balance constraints when responding to unexpected events.

Table 25

Research Question 4 Results

Research Question	Results	
Research Question 4: Are participants exhibiting PM judgment during PM planning tasks?	**Early Strong PM J Thought:** 73% **Early Strong PM J Action:** 40%	**Late Strong PM J Thought:** 60% **Late Strong PM J Action:** 41%
Inquiry Questions	Results	
Inquiry Question 4.1: Interdependent parts: Do participants discuss the connections between PM phases and the interdependence of the parts of a PM plan? *(Post measure)*	• 51 codes for interdependence and 14 for ripple effect. • 12/13 (92%) participants have an interdependence code in their final exam. • Most PM plans were inconsistent.	
Inquiry Question 4.2: Triple constraint: Do participants discuss importance of balancing constraints? *(Post measure)*	• 111 codes for triple constraint. • 10/13 (77%) participants have a triple constraint code in their final exam • Most teams did not balance constraints on their PM plans	
Participants understood PM concepts such as interdependent parts and triple constraint. They also exhibited some common misconceptions and errors. Most PM plans were inconsistent, and teams did not balance constraints when responding to unexpected events.		

Strong PM J Thought was moderate because participants exhibited some of the common PM misconceptions (Table 9). The following are themes of poor reasoning and assumptions found in the data:

- *Hiring more people to get the project completed sooner/ faster:*

> Since we cannot decrease the workload for the whole project and we need to decrease the time, the only thing we can do here is increasing the personnel which can save more time for us. *(Worksheet 2, Anonymous)*

- *Optimistic assumptions about the client:*

> I also assume that the client is reasonable, and would recognize that if such a shortened time frame were possible without additional money or sacrifice, it would have been planned on that time frame in the first place! *(Worksheet 2, Anonymous)*

- *Optimistic assumptions that the project team will work more, harder, or faster:*

> *Quote 1*: We will collate some tasks performed in the project [sic] and the human resource is expected to put extra efforts [sic] in order to complete the project within the new time frame. *(Worksheet 2, Anonymous)*
>
> *Quote 2*: Our assumptions about the project was that we did not need to change anything but we just needed to demand things sooner from our project team. *(Final Exam, Participant 11)*

- *Optimistic assumptions that the project team will have the knowledge and skills to take on new tasks:*

> *Quote 1*: We believe that we have already hired the appropriate people and we have someone that will be able to include instruction on this *(Worksheet 1, Anonymous).*
>
> *Quote 2*: Faculty might feel pressured because of this new change but i [sic] think hiring TAs will be a great idea and TAs can support the faculty to meet the deadlines. *(Worksheet 2, Anonymous).*

The relatively high frequency of the minimize effect code (48) was unexpected. Teams made assumptions to minimize the effect of the zinger. For example, Team B ignored zinger 1 because they assumed that the new technology did not affect the development of instructional templates. Team D minimized the effect of zinger 1 by adding "new multimedia technology" to existing project activities. Minimizing the impact of an unexpected event is an acceptable PM practice (Maley, 2012; Project Management Institute, 2004, 2017) and a type of Strong PM J Thought; however, in this dissertation study, this type of PM judgment reduces the need for (and frequency of) CF and PM J actions.

Inquiry Question 4.1: Interdependent parts: Do participants discuss the connections between PM phases and the interdependence of the parts of a PM plan?

There were many interdependence (51) and ripple effect (14) codes in the data (Table 25). Twelve out of 13 participants (92%) had an interdependence code in their final exam. The following is a typical interdependence code on the final exam:

> When we define the project, then only we will be able to see what it entails and how to go about the next stages of the project management. *(Final Exam, Participant 3)*

These data suggest that participants understood that parts of a PM plan are connected or dependent on one another.

However, the results of RQ 1 indicate that teams submitted PM plans with inconsistencies. Thus, the participants had difficulty executing this type of PM judgment on their revision drafts.

Inquiry Question 4.2: Triple constraint: Do participants discuss importance of balancing constraints?

There were 111 triple constraint codes in the data. Ten out of 13 participants (77%) had a triple constraint code in their final exam.

Triple constraint was coded when the participant's reflection or discussion exhibited an understanding of the connection between common project constraints: cost, time, scope and/or quality. Thus, it was used if at least two of these constraints were mentioned in the same sentence. Also, if the participant mentioned compromises between more than one constraint, the code was used. For example, zinger 2 shortened the project's time, Thus, compromises in *other* constraints, such as quality, were coded. The following were typical triple constraint codes:

> *Quote 1:* The time to produce a project changes with the introduction of new technology, the timeline of different activities need [sic] corresponding change. *(Worksheet 1, Anonymous)*

Quote 2: The budget will probably be affected as hiring additional staff to pick up some of the load would enable us to get things done quicker. *(Worksheet 2, Anonymous)*

Quote 3: It might also necessitate a trade off [sic]/sacrifice in deliverables. *(Worksheet 2, Anonymous)*

Participants had difficulty executing this type of PM judgment as well. As discussed in the RQ 1 results, most teams did not balance constraints while responding to the zingers.

Research Question 5: How does implementing zingers in a progressive case affect PM judgment over a semester?

Participants' levels of PM judgment did not change considerably over the semester (Table 26).

Table 26

Inquiry Questions for Research Question 5

Research Question	Results
Research Question 5: How does implementing zingers in a progressive case affect PM judgment over a semester?	See inquiry results below.
Inquiry Questions	Results
Inquiry Question 5.1: PM plan drafts: What is the percentage of Strong PM Action in response to zinger 1? Zinger 2? *(Time series)*	• 40% (Early): Frequency: 21/53 • 41% (Late): Frequency: 19/46 • **Consistently low (having trouble executing)**
Inquiry Question 5.2: What was the percentage of Strong PM Thought in early phases? Late phases? *(Time series)*	• 73% (Early): Frequency: 79/108 • 60% (Late): Frequency: 193/322 • **Moderate with slight decrease**
Overall, participants' PM judgment did not change over time.	

Inquiry Question 5.1: PM plan drafts: What is the percentage of Strong PM Action in response to zinger 1? Zinger 2?

In the early phase, 40% of PM J Action codes were Strong (Table 26). In the late phase, 41% of PM J Action codes were Strong. PM J Action was consistently low throughout the course and did not change over time.

Inquiry Question 5.2: What was the percentage of Strong PM Thought in early phases? Late phases?

In the early phase, 73% of PM J Thought codes were Strong. In the late phase, 60% of PM J Thought codes were Strong (Table 26). Participants had moderate levels of Strong PM J Thought in both phases, and it decreased slightly over time (13%). Participants were exhibiting both good and poor PM judgment throughout the course.

Summary of Emerging Themes

Several themes consistently emerged from an analysis of these data. Many presented themselves in all teams and across the individual data. The major themes that emerged included:

1. Teams made **assumptions** that affected how they responded to the zingers.
2. Teams exhibited different **best practices and common misconceptions/ errors** when responding to project changes.
3. Participants were **thinking flexibly** throughout the course.
4. Participants made **more changes** to their PM plans **later in the course**.
5. Two teams tried to **minimize** the impact of the zingers.
6. Participants had a moderate understanding of PM concepts, but had **difficulty executing** on PM plans.

These overall trends suggest varying levels of CF and PM judgment were apparent at different points during the progressive case. Thus, teams' and individual participants' thoughts and actions demonstrated different levels of strengths and weaknesses in CF and PM judgment. Further discussion of these themes will be provided in Chapter 5.

Summary

Preparing ID novices for PM responsibilities should thoughtfully and purposively engage learners in *thought and action* around *messy* PM problems to help them develop more expert-like thinking strategies and practice strategies. In this research study, *progressive cases*, cases with emerging or changing constraints, were integrated in an online, graduate-level, PM course to support the development of flexible thinking and PM judgment.

In general, the selected teams approached the zingers differently. In most cases, teams made optimistic assumptions, did not balance constraints, and submitted PM plans with internal inconsistencies. While teams had difficulty executing responses to unexpected changes on their PM plans (low PM J Action, mixed CF Action), they exhibited flexible thinking (very high CF Thought) and an understanding of PM concepts (moderate PM J Thought) in their reflections and discussions. Thus, participants demonstrated more CF than PM judgment, and their *thoughts* exhibited more CF and PM judgment than their *actions*.

In the next chapter, the themes that emerged from this dissertation study will be discussed. Chapter 5 outlines threats to the study and implications of the results. The chapter will suggest future research opportunities on progressive cases to:

- Engage learners in *thought and action*.
- Prepare novices to respond to unexpected events and solve messy problems.

Chapter 5

Introduction

"Considering the dynamic environments in which [instructional] designers of the future will work, ID educators will be expected to help their students have classroom experiences that closely align with the new demands those novices will face" (Slagter van Tryon et al., 2018, p. 150).

A recent analysis of instructional design (ID) job postings found that *all* instructional designers (IDs) need competencies in project management (PM), and advanced roles need skills in PM and change management (Kelly, 2016). While researchers recommended that ID professional development (PD) include PM (Kelly, 2016; Larson & Lockee, 2009), less than a quarter of graduate-level ID programs include PM courses (Williams van Rooij, 2010), resulting in a gap between ID PD and real-world practice (Larson & Lockee, 2009; Olson, 2018). This gap leaves novice IDs ill-prepared to perform in their roles.

The few ID programs that offer PM courses may be doing so ineffectively because research on *how to develop* PM competencies is lacking (Savelsbergh et al., 2016). This dissertation study seeks to contribute to the literature on ID PD and PM PD, particularly by investigating how to align PD and practice to facilitate the application of learned skills in the workplace (*transfer*).

To facilitate transfer, PD should provide opportunities for novices to experience and react to *complex* and *dynamic* projects that are like what they will encounter in the real world. This dissertation study investigated a new way to thoughtfully and purposively engage ID novices in *thought and action* around *messy* PM problems to prepare them for future PM responsibilities. Novice IDs in a graduate, online PM course were tasked to write a PM plan for the development of an instructional product that would solve a problem presented in a case scenario. The activity introduced the students to basic PM concepts such as the project phases, tools and templates, and the *triple constraint*. To simulate the complex and dynamic nature of real-world projects, *zingers* (realistic and unexpected challenges) were introduced in different parts of the *progressive case*, interrupting the PM work process and prompting reactions involving flexible thinking and judgment.

In a progressive case, the learners are *making and implementing their own decisions "*based on *new information* that *affects the problem constraints or solution requirements"* (Souid & Koszalka, 2018). Thus, progressive cases involve learners *in thought and action* under *dynamic* conditions. Progressive cases require the learner to adjust their thinking, plans, and solutions to respond to common events that emerge during project planning. This may help novices develop more expert-like *thinking strategies* (e.g., flexible thinking and judgment) and *practice strategies* (e.g., flexible and iterative planning actions)—strategies that will support their transition from PD to the workplace.

This is different than the current approach to teaching PM and ID that involves *static cases* that only engage learners in *discussions* about the case problem (Barnes et al., 1994). While static activities can provide vicarious experience (Jonassen & Hernandez-Serrano, 2002; Tawfik & Jonassen, 2013) and help novices bridge theory and practice (Graf, 1991; Hudspeth & Knirk, 1989), they do not engage novices in the complex, dynamic nature of projects (Bannan-Ritland, 2001; Thomas & Mengel, 2008). Thus, they, and other *neatened* (Spiro et al., 1987) learning experiences, may contribute to the transfer issues that are reported in ID literature (Fortney & Yamagata-Lynch, 2013; Larson, 2005) and PM literature (Egginton, 2012).

This dissertation study employed the case study research method (CSRM) to *describe* the learning process while engaging with a dynamic problem within a progressive case. Since progressive cases engage learners in *thought and action*, a data analysis framework was developed to track the *frequency of thoughts and actions exhibiting good and poor flexible thought* (cognitive flexibility, CF) *and PM judgment* (PM J). Within the CSRM, a time-series analysis was used to track these levels of CF and PM J thoughts and actions over time. Although this study was descriptive, rather than interventional, changes in CF and PM judgment can be attributed to the presentation of zingers because of the chronological and contingent sequence of the course design (Yin, 2018). Thus, some of the discussions in this chapter draw upon the causal inferences the researcher can make using time-series data.

This dissertation study seeks to inform the design of PD, particularly the design of instruction utilizing the case-based method (CBM), to support the development of the expert-like thinking strategies and practice strategies required to respond to unexpected events and solve messy problems.

The results of the following research questions were presented in the previous chapter and are summarized in Table 27.

1. How do teams respond to unexpected changes during PM planning tasks?
2. Are participants exhibiting CF during PM planning tasks?
3. How does implementing zingers in a progressive case affect CF in participants over a semester?
4. Are participants exhibiting PM judgment during PM planning tasks?
5. How does implementing zingers in a progressive case affect PM judgment over a semester?

The following themes emerged from the results of this dissertation study:

1. Teams made **assumptions** that affected how they responded to the zingers.
2. Teams exhibited ***different*** **best practices and common misconceptions/ errors** when responding to project changes.
3. Participants were **thinking flexibly** throughout the course.
4. Participants made ***more*** **changes** to their PM plans **later in the course**.
5. Two teams tried to **minimize** the impact of the zingers.
6. Participants had a moderate understanding of PM concepts, but had **difficulty executing** on PM plans.

Each theme will be discussed in more detail with considerations of consistent and inconsistent evidence from the literature.

Finally, the chapter describes threats to the dissertation study, future research on progressive cases, and implications for ID and PM PD.

Data Analysis Framework

The data analysis framework contains four Level 1 codes: CF Thought, PM J Thought, CF Action, and PM J Action. Each Level 1 code is designated as *strong* or *weak*. Strong codes are related to best practices for avoiding, mitigating, and accepting change requests (Table 13), while Weak codes are related to the common misconceptions/ errors (Table 14).

Strong CF is demonstrated when participants think flexibly by considering different perspectives (Spiro et al., 1988), seeking alternative solutions (M. M. Martin & Rubin, 1995, p. 623), and adjusting their thinking and PM plans to new task demands (Krems, 1995). Strong CF Action was coded when the participant made a revision in their PM plan that demonstrated the execution of flexible thought.

Strong PM J is demonstrated when participants *protect or balance the triple constraint* (Maley, 2012; Project Management Institute, 2004) and *manage the interdependent parts* of PM plans (Project Management Institute, 2017). Strong PM J Action was coded when good PM judgment was *executed* to keep the plan consistent or protect or balance constraints.

Summary of the Results

Figure 21 outlines the results of the dissertation study by Level 1 code. Strong CF Thought was very high throughout the course and did not change over time. Strong PM J Thought was moderate throughout the course and slightly decreased over time. Strong CF Action increased dramatically over time. Strong PM J Action was low throughout the course and did not change over time. The Level 1 trends informed the themes discussed in this chapter.

Figure 21

Summary of the Results by Level 1 Code

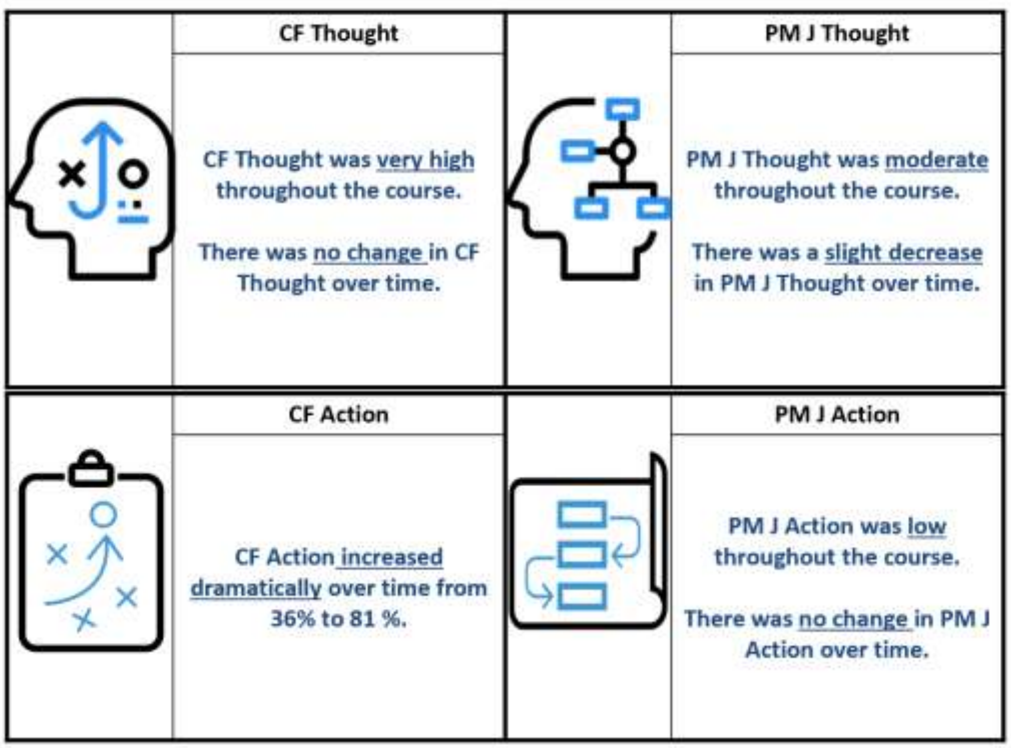


Table 27 is a summary of the results by research question. All the themes are aligned with the results of at least one research question.

Table 27

Summary of the Results by Research Question and Emerged Themes

Research Question	Results	Emerged Theme(s)
How do teams respond to unexpected changes during PM planning tasks?	In general, teams had difficulty responding to unexpected changes during PM planning tasks. Their assumptions about the zinger and their project deliverable affected their overall approach. In most cases, teams made optimistic assumptions, did not balance constraints, and submitted PM plans with internal inconsistencies. However, teams did consider multiple, valid approaches (ex. ask for more resources, say "It's not possible.", etc.), but did not commit to these ideas.	• **Theme 1:** Teams made **assumptions** that affected how they responded to the zingers. • **Theme 2:** Teams exhibited *different* **best practices and common misconceptions/ errors** when responding to project changes.
Are participants exhibiting CF during PM planning tasks?	Based on quantitative and qualitative measures, participants' levels of CF thought were consistently high throughout the course. On their final exams, some participants discussed how PMs need to be flexible and respond to unexpected changes.	• **Theme 3:** Participants were **thinking flexibly** throughout the course.
How does implementing zingers in a progressive case affect CF in participants over a semester?	Based on quantitative and qualitative measures, participants' levels of CF thought were consistently high throughout the course. Their behaviors (execution on PM plans) increased dramatically.	• **Theme 4:** Participants made **more changes** to their PM plans **later in the course**.
Are participants exhibiting PM judgment during PM planning tasks?	Participants understand PM concepts such as interdependent parts and triple constraint. However, most PM plans were inconsistent, and teams did not balance constraints when responding to unexpected events. Teams minimized the effect of the zingers.	• **Theme 5:** Two teams tried to **minimize the impact** of the zingers. • **Theme 6:** Participants had a moderate understanding of PM concepts, but had **difficulty executing** on PM plans.
How does implementing zingers in a progressive case affect PM judgment over a semester?	Participants' PM judgment did not change over time.	

Themes

Theme 1: Teams made assumptions that affected how they responded to the zingers.

The teams in this dissertation study made two types of assumptions when responding to the zingers. These assumptions affected how they thought and acted in the progressive case. The first type involved structuring the problem. The second type was making optimistic PM assumptions, one of the common errors/ misconceptions discussed in PM literature.

Making Assumptions to Structure Messy Case Problems

The progressive case in this dissertation study was intentionally ambiguous (Golich, 2000) to mirror the *messiness* of real-world problems (Jonassen, 2008). "An effective case problem is ambiguous and messy, requiring students to identify, analyze, and consider multiple contributing factors and possible solutions and requiring student groups to deal with conflicting values and multiple perspectives" (Dabbagh & Dass, 2013, p. 163).

When the case is ambiguous, students need to make and substantiate assumptions (Dabbagh & Dass, 2013). Consistent with CBM literature, teams made assumptions to firm up some of the uncertainty and ambiguity in the progressive case. For example, in the first zinger, the client representative asked the teams to add a new multimedia deliverable to the project plan but did not prescribe a specific technology. Team A assumed that the new technology was an online bulletin board application and Team D assumed it was PowerPoint. While each team made different assumptions (Theme 2), each assumption was valid because it was reasonable and explicit.

Fortney and Yamagata-Lynch (2013) found that experts tolerate more ambiguity than novices when solving workplace problems. When experts encountered missing data or issues, they made assumptions to reduce ambiguity. Novices in their study reacted to ambiguity with frustration and were reluctant to propose solutions when they did not have all the data. The results of this dissertation study are inconsistent with Fortney and Yamagata-Lynch (2013). It appears that participants were making assumptions like experts do, despite having little to no PM experience. It is possible that inconsistency stems from a difference in research contexts. The novices in Fortney and Yamagata's study (2013) may have been less likely to take risks in ambiguous situations because they were at work, while participants in this dissertation study were working on a hypothetical case within ID PD, where the stakes are lower and learning by failing is more accepted.

Making assumptions is an important part of PM practice. PMs need to make assumptions to move forward when necessary information is unavailable (Doraiswamy & Shiv, 2012). PMs' assumptions must be explicit (Kliem, 2011) and visible (Doraiswamy & Shiv, 2012). Ill-defined assumptions can lead to project failure (Kliem, 2011) and wrong assumptions can require re-work (Doraiswamy & Shiv, 2012). Some of the assumptions the teams made in this dissertation study would have led to project failure or re-work. For example, Team B assumed that the first zinger did not affect their project. If they had delivered a product without the multimedia component, the client could have rejected the work.

Optimistic Project Management Assumptions

Every team in this dissertation study made optimistic PM assumptions (Theme 2). For example, in response to zinger 1, one participant wrote:

> The assumptions that I have are that the tool will not cost us extra time *(Worksheet 2, Anonymous).*

When zinger 2 shortened the project timeline, participants made optimistic assumptions such as "*Hiring more people will help us complete the project faster."* and *"The project team will work more, harder, or faster."*. Since the participants had little to no PM experience, they did not consider common work norms and challenges, like burnout. The course did include resources explaining that adding more people to a project will not necessarily shorten the timeline. It is possible that the students did not read the resources, did not understand the resources, and/or understood the concept but were naturally optimistic.

This is consistent with PM literature. When PMs are dealing with ambiguity and uncertainty, they tend to make optimistic assumptions (Davis & Radford, 2014). For example, PMs may make optimistic estimates about the amount of work that can be done in a period (Biafore & Stover, 2012). To combat this natural bias for optimism, PMs should make three estimates (optimistic, most likely, and pessimistic) and calculate a weighted average (Biafore & Stover, 2012). Participants in this dissertation study were not given such a heuristic to validate their assumptions.

Theme 2: Teams exhibited *different* best practices and common misconceptions/ errors when responding to project changes.

In Chapter 2, PM literature was reviewed to outline best practices and common misconceptions/errors when responding to project changes (Table 9). The tables in this section (Table 28, Table 29, Table 30) map the observed trends within each team's response (highlighted in gray). When the visualizations are compared, teams exhibited *different* best practices and common misconceptions/errors when responding to project changes.

This was expected because messy problems do not have a single correct solution. The progressive case was designed to have multiple acceptable solutions so teams could exhibit any combination of best practices in CF and PM judgment.

Team A (Many Changes)

The observed trends for Team A are highlighted in gray in Table 28.

Table 28

Mapping Team A to Best Practices and Common Misconceptions/ Errors

	Team A (Many Changes)		
	Best Practices: Avoiding	Best Practices: Mitigating/ Accepting	Common Misconceptions/ Errors
Cognitive Flexibility	☐ Think about alternatives to the client's request, including saying no and providing realistic options ☐ Consider whether the proposed change is consistent with the project priorities	☐ Adjust thinking and PM plans to the new task demands ☐ Seek alternative solutions and perspectives ☐ Use flexible decision making (ex. late locking) ☐ Consider project priorities	☐ Over-promising: Accepting the client's request without asking for clarification, questioning the need/ value, or trying to compromise ☐ Not updating the PM plan after a change is accepted
PM Judgment	☐ Ask for justification for the change ☐ Explain the impact of the change using the triple constraint ☐ Predict cumulative impacts of proposed changes, especially late in the project ☐ Explain how the change will result in ripple effects	☐ Anticipate the impact ☐ Write a flexible PM plan, ex. iterative scheduling ☐ Use progressive elaboration ☐ Build contingency ☐ Keep triple constraint balanced by re-negotiating or making trade-offs ☐ Ripple the impact of the change throughout the plan ☐ Ensure the plan is consistent ☐ Reallocate under-utilized resources ☐ Add resources on the critical path to reduce project time (depends on the nature of the task)	☐ Inconsistent PM plan ☐ Underestimating impact of the change ☐ Insufficient contingency ☐ Making optimistic assumptions: Expecting the project team to work harder (ex. paid or unpaid overtime); hiring more people to reduce project time ☐ Imbalanced triple constraint (ex. not charging the client for increased scope) ☐ Inaccurate estimations of activity duration and productivity

Team A exhibited many of the CF best practices related to avoiding, mitigating, and accepting a project change. For example, they exhibited: *Think about alternatives to the client's request, including saying no, and providing realistic options.* For example, during the first virtual session, one team member suggested using a phased approach by delivering a pilot or proof of concept first to determine if the new multimedia added value (Harrin, 2013).

The visualization of Team A's responses is supported by their distribution of Level 1 codes. Team A had high levels of CF Thought (93%, 91%) and CF Action (60%, 77%) in the early and late phase.

However, Team A demonstrated a mixture of best practices and common misconceptions/ errors in PM judgment (Table 28). Many of the best practices they exhibited were related to the *impact of the zinger* (ex. anticipate the impact, ripple the impact of the change throughout the plan). Despite this, Team A exhibited some common misconceptions/ errors including developing an inconsistent PM plan, making optimistic assumptions, and not balancing the triple constraint. The even distribution in the visualization is supported by high and low levels of PM J Thought (86% early, 46% late) and PM J Action (72%, 41%) in the early and late phases, respectively.

Table 29

Mapping Team D to Best Practices and Common Misconceptions/ Errors

Team D (Minimize Impact and Slack)			
	Best Practices: Avoiding	Best Practices: Mitigating/ Accepting	Common Misconceptions/ Errors
Cognitive Flexibility	☐ Think about alternatives to the client's request, including saying no and providing realistic options ☐ Consider whether the proposed change is consistent with the project priorities	☐ Adjust thinking and PM plans to the new task demands ☐ Seek alternative solutions and perspectives ☐ Use flexible decision making (ex. late locking) ☐ Consider project priorities	☐ Over-promising: Accepting the client's request without asking for clarification, questioning the need/ value, or trying to compromise ☐ Not updating the PM plan after a change is accepted
PM Judgment	☐ Ask for justification for the change ☐ Explain the impact of the change using the triple constraint ☐ Predict cumulative impacts of proposed changes, especially late in the project ☐ Explain how the change will result in ripple effects	☐ Anticipate the impact ☐ Write a flexible PM plan, ex. iterative scheduling ☐ Use progressive elaboration ☐ Build contingency ☐ Keep triple constraint balanced by re-negotiating or making trade-offs ☐ Ripple the impact of the change throughout the plan ☐ Ensure the plan is consistent ☐ Reallocate under-utilized resources ☐ Add resources on the critical path to reduce project time (depends on the nature of the task)	☐ Inconsistent PM plan ☐ Underestimating impact of the change ☐ Insufficient contingency ☐ Making optimistic assumptions: Expecting the project team to work harder (ex. paid or unpaid overtime); hiring more people to reduce project time ☐ Imbalanced triple constraint (ex. not charging the client for increased scope) ☐ Inaccurate estimations of activity duration and productivity

Team D (Minimize Impact and Slack)

Team D's observed responses to the zingers are mapped to the best practices and common misconceptions/ errors in CF and PM judgment (Table 29). This visualization suggests that Team D demonstrated a mixture of mitigating/ accepting best practices and common misconceptions/ errors in CF and PM. This is supported by the extreme ranges of levels of Strong CF Thought (94% early, 92% late), Strong CF Action (40%, 17%), Strong PM J Thought (100%, 53%), and Strong PM J Action (0%, 62%). Compared to Team A (Table 28), Team D demonstrated *fewer* best practices for avoiding change and *more* common misconceptions/ errors.

Team B (Avoidance and Weak Response)

Team B's responses to the zingers are mostly aligned with common misconceptions/ errors in PM judgment (Table 30). This is supported by a consistently low level of PM J Action during the course (0%). In the late phase of the course, Team B exhibited one of the CF best practices: *adjust thinking and PM plans to new task demands*. This is supported by an increase in Strong CF Action (from 0% in the early phase to 90% in the late phase). Compared to Team A and Team D, Team B used the *fewest* CF and PM best practices and made some common PM errors.

As discussed in *Theme 1,* teams made optimistic assumptions that affected how they responded to zingers. The visualizations developed in this section support Theme 1. Every team demonstrated the following common misconceptions/ errors in PM:

- Making optimistic assumptions: Expecting the project team to work harder (ex. paid or unpaid overtime); hiring more people to reduce project time
- Imbalanced triple constraint (ex. not charging the client for increased scope)

Table 30

Mapping Team B to Best Practices and Common Misconceptions/ Errors

	Team B (Avoidance and Weak Response)		
	Best Practices: Avoiding	Best Practices: Mitigating/ Accepting	Common Misconceptions/ Errors
Cognitive Flexibility	☐ Think about alternatives to the client's request, including saying no and providing realistic options ☐ Consider whether the proposed change is consistent with the project priorities	☐ Adjust thinking and PM plans to the new task demands ☐ Seek alternative solutions and perspectives ☐ Use flexible decision making (ex. late locking) ☐ Consider project priorities	☐ Over-promising: Accepting the client's request without asking for clarification, questioning the need/ value, or trying to compromise ☐ Not updating the PM plan after a change is accepted
PM Judgment	☐ Ask for justification for the change ☐ Explain the impact of the change using the triple constraint ☐ Predict cumulative impacts of proposed changes, especially late in the project ☐ Explain how the change will result in ripple effects	☐ Anticipate the impact ☐ Write a flexible PM plan, ex. iterative scheduling ☐ Use progressive elaboration ☐ Build contingency ☐ Keep triple constraint balanced by re-negotiating or making trade-offs ☐ Ripple the impact of the change throughout the plan ☐ Ensure the plan is consistent ☐ Reallocate under-utilized resources ☐ Add resources on the critical path to reduce project time (depends on the nature of the task)	☐ Inconsistent PM plan ☐ Underestimating impact of the change ☐ Insufficient contingency ☐ Making optimistic assumptions: Expecting the project team to work harder (ex. paid or unpaid overtime); hiring more people to reduce project time ☐ Imbalanced triple constraint (ex. not charging the client for increased scope) ☐ Inaccurate estimations of activity duration and productivity

In summary, the teams' responses to the project changes were mapped. By comparing these visualizations, it is evident that the teams exhibited *different* best practices and common misconceptions/ errors when responding to project changes. This was expected because *messy* problems do not have a single correct solution. The progressive case was designed to have multiple acceptable solutions so teams could exhibit any combination of best practices in CF and PM judgment.

Theme 3: Participants were thinking flexibly throughout the course.

The researcher hypothesized that participants would exhibit more CF in the late phase. Participants would think more flexibly about zinger 2 because they had experience dealing with zinger 1. Thus, Strong CF Thought was hypothesized to increase, and Weak CF Thought was hypothesized to decrease.

As discussed in Chapter 4, Strong CF Thought was high throughout the course and did not change. Therefore, there is evidence that the participants started and ended the course with high levels of one of the *thinking strategies,* flexible thought.

While the participants were still developing their knowledge of PM concepts in the early phase, they were thinking flexibly throughout the course. Krems (1995) investigated the relationship between domain knowledge and flexible problem solving behavior, and found mixed results. Experts generated more plausible solutions and considered counter-examples and exceptions. This suggests that experts have higher CF. Yet, it was also found that domain knowledge does not affect one's ability to adapt and adjust their problem solving to new constraints (Krems, 1995). The latter result provides support to this theme. It is possible that participants in this dissertation study had developed CF during their previous ID PD experiences, and that their CF could be transferred from an ID to PM domain.

Literature suggests individuals with higher levels of CF make better decisions in ambiguous and risky situations (Dong et al., 2016) and perform better when working on well-structured *and* ill-structured problems (Laureiro-Martínez & Brusoni, 2018). The results of this dissertation study contradict CF literature. While participants had high levels of CF throughout the course, they did not demonstrate strong decision-making or performance on their PM revision drafts. As discussed in Theme 1, participants made assumptions that affected their responses; these assumptions may have decreased the quality of their decision-making and performance. It is also possible that participants needed more training on how to use their CF to make good decisions.

Also, there are some differences between these studies and this dissertation study. Dong and colleagues (2016) studied CF and decision making using a validated problem solving game with a set of rules, not using CBM or PD. Lauereiro-Martinez and Brusoni's (2018) study did not involve CBM or PD either. Rather, they studied how CF and decision making while participants solved structured and ill-structured problems. Also, participants in their study were not novices; they were of senior executives with at least four years of managerial experience.

Theme 4: Participants made more changes to their PM plans later in the course.

The researcher hypothesized that participants would make more changes to their PM plans later in the course. To respond to zinger 1, participants need to go back and adjust their thinking and PM plans. This experience may help participants develop CF during the early phase, resulting in more flexible actions in the late phase. Thus, Strong CF Action would increase, and Weak CF Action would decrease over time. Also, since zinger 1 was presented *before* the drafting the last two phases (Control and Close), zinger 1 affected fewer sections of the PM plan. Thus, the participants had shorter PM plans to revise in the early phase of the course which may reduce the number of necessary edits.

In the early phase of the course, the total number of Action codes (Strong CF Action, Weak CF Action, Strong PM J Action, and Weak PM J Action) was 131. This almost doubled in the late phase (257). Strong CF Action, an indicator of the *number and quality* of edits made on PM plans, dramatically increased from 36% to 81%. These results may be explained by one or more of the following:

- Participants developed more *practice strategies* (e.g., flexible and iterative actions) after dealing with the first zinger. This would support the researcher's hypothesis that participants would develop CF through experience and practice.
- Zinger 2 affected more portions of the PM plan (three phases vs. five phases). Thus, the total frequencies of Action codes may be correlated with the length of the PM plan. However, the researcher calculated and reported the *percentages* of Strong and Weak codes *within each phase* to correct for this. Thus, since the percentage of Strong CF Action dramatically increased (36% to 81%), this explanation is unlikely.
- While minimizing the impact of a zinger is a best practice, this strategy reduces the need to make edits to the PM plan. Two teams minimized the impact of zinger 1 (Theme 5). Team B ignored zinger 1 by making assumptions that the new multimedia element did not affect their PM plan (Theme 1). Team D used two valid PM planning strategies, *progressive elaboration* (Project Management Institute, 2004) and *late locking* (Olsson, 2006), to add details to their PM plan to accommodate the new multimedia element. The minimizing of zinger 1 lowered the frequency of Action codes in the early phase, contributing to a dramatic increase in the late phase.
- Teams also made assumptions about zinger 2 (Theme 1), but these assumptions did not minimize the impact of the zinger. Rather, their assumptions were related to PM concepts, and were coded as PM J Thought or PM J Action. For example, assuming that hiring more people will decrease the project timeline is a type of Weak PM J Thought; however, this assumption *does not reduce the number of*

edits needed to respond to the zinger. Therefore, all teams made many edits to adjust their project schedule. This may have increased the percent of Strong CF Action codes in the late phase, contributing to a dramatic increase over time.

- The participants may have had *types of flexible thinking strategies* that were better suited for the change in project schedule (zinger 2). PM literature suggests that different project issues require different thinking strategies (Bjorvatn & Wald, 2018). Two *absorptive capacities, knowledge transformation and knowledge exploitation,* can reduce project delays (Bjorvatn & Wald, 2018). *Knowledge transformation* consists of combining existing and new knowledge. *Knowledge exploitation* involves leveraging and utilizing new knowledge. These types of absorptive capacity are related to characteristics of CF, particularly making interconnections between content and cases (Spiro et al., 1988). Since participants had high levels of CF Thought, they may also have had high levels of these two absorptive capacities that help prevent project delays. These absorptive capacities may be less helpful when dealing with changes in project scope.

Theme 5: Two teams tried to minimize the impact of the zingers.

According to international PM standards, when facing a project change, a PM has three main options: ignore the change (avoid), minimize the impact of the change (mitigate), or accommodate the change (accept) (Project Management Institute, 2017). Minimizing the impact of an unexpected event is an acceptable PM practice (Maley, 2012; Project Management Institute, 2004, 2017). In fact, “minimizing the effects of change is a key responsibility of the project manager and the project sponsor” (T. C. Williams, 2011). When participants minimized the impact of the zinger, the minimize effect code was used. This was a sub-code of the Level 1 code, Strong PM J Thought.

The frequency of the minimize effect code (48) is higher than expected. Teams made assumptions about the zinger to minimize the impact of the proposed change. In eight instances (17%) these assumptions were optimistic (Theme 1) and were also coded with a Weak PM J Thought code, poor reasoning/ assumptions. For example, Team B ignored zinger 1 because they assumed that the new technology did not affect the development of instructional templates:

> this [sic] common templates [sic] followed the ADDIE model and irrespective of the technology platform used. *(Final Exam, Participant 5)*

In another example, a participant assumed that the project staff had transferrable skills that could support the new multimedia element introduced in zinger 1:

> Quote 1: Furthermore, the personnel likely needed to add this element are not only already accommodated for, as they are needed for similar tasks in the original project design, but they are integrated in the project at the same time/phase that we would add this new multimedia element in. *(Worksheet 1, Anonymous)*

Another participant made assumptions about the nature of the multimedia element:

> Quote 2: Without having many of the details of this multimedia component, I have made some assumptions about its nature and features being similar to other media elements in the original project, and potentially about the amount and cost it would require to achieve it. *(Worksheet 1, Anonymous)*

These examples suggest that participants were exhibiting good PM judgment (e.g., minimizing the effect) and poor PM judgment (e.g., optimistic assumptions) at the same time.

Beyond making assumptions, Team D minimized the zinger by using a PM strategy, *progressive elaboration.* Progressive elaboration entails developing broad plans and adding details as more is known about the project. In their first revision draft, Team D added "new multimedia technology" to existing project activities (Figure 18). These edits were coded as Strong CF Action (frequency, 19) because they were primary to the zinger constraint (e.g., scope). While this approach did result in some edits, it also allowed them to minimize the impact of the zinger on *other constraints*, resulting in no Strong PM J Action codes (frequency, 0) in the early phase.

In summary, this theme affects the dissertation study's results in unexpected ways. Although minimizing the impact of an unexpected event is recommended practice, this type of good PM judgment reduces the number of revisions required on the PM plans, and thus, lowers the frequency of CF Actions and PM J Actions (Theme 4). Since minimizing the impact of the zinger is a Strong PM J Thought code that reduces all Action codes, it may have contributed to the gap between participants' thoughts and actions (Theme 6).

Theme 6: Participants had a moderate understanding of PM concepts, but had difficulty executing on PM plans.

The researcher hypothesized that participants would exhibit more PM judgment in the late phase. Once zinger 1 is presented, the case becomes *progressive* and begins simulating the *messiness* of real-world projects. After dealing with a realistic and unexpected event (zinger 1), participants would become more familiar with PM concepts, such as the triple constraint and interdependent parts. When they are presented with zinger 2, they would have an opportunity to execute the thinking and practice strategies they developed during the early phase of the course. Thus, Strong PM J Thought was hypothesized to increase, and Weak PM J Thought was hypothesized to decrease.

The researcher hypothesized that Strong PM J Action would increase and Weak PM J Action would decrease over time. Participants would be better prepared to make revisions in response to zinger 2 because they would develop PM knowledge and practice strategies during the early phase. Also, since zinger 1 was presented *before* the drafting the last two phases (Control and Close), zinger 1 affected fewer sections of the PM plan, resulting in fewer ripples.

PM J Thought was moderate throughout the course, and slightly decreased over time (73% to 60%). PM J Action was low throughout the course and did not change over time (40% to 41%). These results are contrary to the hypotheses. Theme 6 explores explanations for the observed deficiencies in PM judgment.

Theme 6.1: Participants executed flexible thought more frequently than they executed PM judgment.

Only about 25% of edits on the PM plans were coded with PM J Action codes. This is consistent with the other themes. Participants were thinking flexibly (Theme 3) and executed some flexible thought; however, there were very few Strong PM J Action codes (21 and 19) and no change in Strong PM J Action over time (40% to 41%).

It is not surprising that the frequency of Strong CF Action codes (198) was higher than the frequency of Strong PM J Action codes (40). Strong CF Action edits are more basic and do not require domain knowledge in PM. Strong CF Action was coded when participants made edits that were *primary* to the zinger constraint (e.g., zinger 1 affected the project scope, so any changes to the project scope were coded as Strong CF Action). Strong PM J Action was coded when the participants made an edit to the PM plan to balance constraints or ripple the change consistently. Thus, Strong PM J Action codes require more higher-order thinking and a strong understanding of two PM concepts, triple constraint and interdependent parts. If the participants were still developing an understanding of these concepts, it would be difficult for them to apply them on their PM plans (Theme 6.3).

Theme 6.2: Participants executed poor PM judgment more often than they executed good PM judgment.

Weak PM J Action (60% and 59%) was higher than Strong PM J Action throughout the course (40% and 41%). This suggests that participants executed poor PM judgment more often than they executed good PM judgment. This is supported by CBM and professional development (PD) literature.

In Lee-kelley's (2018) study, *experienced PMs* had difficulty reacting to unexpected events introduced during a three-day, face-to-face simulation. Despite having knowledge and experience in PM, participants demonstrated the following deficiencies in PM application and transferable skills:

- Participants did not explore future risks.
- Participants did not create mitigation plans to prepare for unexpected events.
- Participants did not take risks.
- Participants were over-confident.

Thus, research suggests that *experienced PMs* exhibit and execute poor PM judgment during a progressive case. If experienced PMs have difficulty responding to unexpected events in CBM, novice PMs with little to no prior PM experience cannot be expected to demonstrate high levels of PM judgment in *messy* situations after only a few weeks of PD.

Research suggests that PM PD and ID PD helps learners understand the language of PM and apply fundamental knowledge and skills (Egginton, 2012; Nall, 2018). After PD, learning continues on the job (Maharaj, 2020; Nall, 2018; Savelsbergh et al., 2016). In fact, most learning experiences for PMs occur accidently on the job (Savelsbergh et al., 2016). These post-PD experiences help PMs develop a broader view of their role, including seeing the bigger picture and looking ahead (Savelsbergh et al., 2016)—perspectives that may help PMs react to unexpected changes in a project.

Theme 6.3: Participants could not yet* apply *PM judgment because they were developing an* understanding *of basic PM concepts.

PM J Thought was higher (73%, 60%) than PM J Action (40%, 41%) throughout the course. This may indicate that participants, who had little to no prior PM experience, were *developing an understanding* basic PM concepts, but could not yet execute (*apply*) this thinking.

It may be difficult for learners to improve higher-order thinking skills when they lack other required skills for the activity (like team work, communication, and leadership) (Rumeser & Emsley, 2019). Following this logic, it may be difficult for participants to improve their PM judgment if they lack or are in the process of developing an understanding of basic PM concepts. The Revised Bloom's Taxonomy ranks cognitive processes from the simplest to the most complex: remember, understand, apply, analyze, evaluate, and create. Simpler cognitive processes are prerequisites for more complex cognitive processes (Krathwohl, 2002). Thus, learners need to understand content before they can apply it.

In a similar study looking at a progressive case in PM, Lee-kelley found that experienced PMs understood PM concepts but could not apply or transfer PM skills to the case problem. The researcher found that the "transition from merely knowing-what to effective practice is not straightforward" (Lee-kelley, 2018, p. 206). Practical application and transferable skills require PMs to move beyond being "experienced actors" to becoming "reflective experts" (Lee-kelley, 2018, p. 205). This dissertation study provides support to Lee-kelley's finding that adults need to develop understanding of PM concepts before they can apply it within a progressive case.

Research suggests that a PM's prior project experience (Sharma et al., 2019) and level of development (Savelsbergh et al., 2016) impact what they learn within a certain piece of instruction. In their first PD experiences, novices learn about PM practice and PM fundamentals (Savelsbergh et al., 2016; Thomas et al., 2004). As they gain experience, PMs develop a broader view of their role and learn the soft skills needed to deliver successful projects (Savelsbergh et al., 2016). This suggests that when given the same progressive case, novices will learn basic PM concepts while experienced PMs will learn more advanced skills, like PM judgment.

This is supported by Rumeser & Emsley's (2019) study on the impact of PM simulations on learners' decision making. They found that the learners' level of experience was related to the effectiveness of the PM simulations. When the simulation was complex, experienced learners' decision-making skills improved more than those of less experienced players. Thus, progressive cases containing *complex* problems may be more effective when learners are experienced.

Within ID PD literature, Julian, Kinzie, and Larsen (2000) also found that learners' prior experiences affected what they learned within CBM instruction. Less experienced IDs reported developing an understanding of ID concepts and an appreciation of certain components of ID work. More experienced IDs made connections between the case and workplace challenges. Yet, all learners became more aware of the knowledge and skills they will need in the workplace and that ID practice will require them to go beyond ID theories and models. While the participants in this dissertation study had difficulty applying PM judgment, they appear to have developed more awareness that ID and PM practice is *messy*.

Von Wagenheim et al.'s study (2012) contradicts the results of this dissertation and other studies discussed in this section (Julian et al., 2000; Rumeser & Emsley, 2019; Savelsbergh et al., 2016). Von Wagenheim et al. (2012) developed a board game to teach players how to monitor and control projects. Like this dissertation study, players needed to adjust their PM plan when unexpected events occurred. After playing the game, players self-reported their levels of learning within the first three levels of Bloom's taxonomy. Learners reported that the game helped them remember, understand, and apply the skills presented in the game. However, they reported the highest learning in the application level rather than in the lower levels of the taxonomy. It is possible that when learners self-reported their learning, they over-estimated their ability to apply the concepts. This dissertation study suggests that the application of knowledge is difficult for novices; it may be so difficult that the participants were not aware that they were underperforming on their PM plans.

Summary of Results and Themes

A strength of this dissertation study is that the data consistently support the answers to the research questions and themes. The *quantitative data* (e.g., pre-measure and post-measure of CF using a validated instrument), *qualitative data* (e.g., distributions between Strong and Weak codes), and *visualizations* (e.g., mapping best practices and common misconceptions/ errors for each team) tell the same story. Participants demonstrated more CF than PM judgment, and their thoughts exhibited more CF and PM judgment than their actions. However, since this dissertation study was descriptive rather than interventional, there are many possible explanations for the dissertation study's results and themes (Table 31). The researcher suggests *possible* explanations based on her analysis of the data, learning theories, and CBM literature.

Within the bounds of this dissertation study, it appears that CF is a thinking strategy that can be transferred from context to context, regardless of the domain (Krems, 1995). However, it is possible that the CF instrument may have not been sensitive enough to detect changes or might have been measuring a stable trait. It is unclear why participants did not execute their high levels

Table 31

Possible Explanations for Level 1 Code Trends

Level 1 Code	Trends	Related Theme(s)	Possible Explanation(s)
CF Thought	CF Thought was <u>very high</u> throughout the course (94% to 93%). There was <u>no change</u> in CF Thought over time.	**Theme 3:** Participants were thinking flexibly throughout the course.	Participants developed high CF during prior experiences, such as ID PD, and could transfer it to a new context. The CF instrument may have not been sensitive enough to detect changes or might have been measuring a stable trait.
PM J Thought	PM J Thought was <u>moderate</u> throughout the course (73% and 60%). There was a <u>slight decrease</u> in PM J Thought over time.	**Theme 6:** Participants had a moderate understanding of PM concepts, but had difficulty executing on PM plans.	Participants developed a moderate understanding of PM fundamentals by engaging with course materials (ex. readings, quizzes) and the progressive case.
CF Action	CF Action <u>increased dramatically</u> over time from 36% to 81%.	**Theme 4:** Participants made more changes to their PM plans later in the course.	Participants made more changes to their PM plan in the last phase because: • They learned *practice strategies* to execute their CF in a new context (PM), and/or, • Teams minimized zinger 1, and/or, • The zingers may prompt different responses
PM J Action	PM J Action was <u>low</u> throughout the course (40% to 41%). There was <u>no change</u> in PM J Action over time.	**Theme 6.2:** Participants executed poor PM judgment more often than they executed good PM judgment.	Literature suggests that even experienced PMs have difficulty applying PM judgment in progressive cases. Many PMs learn this on the job. Participants needed more time/ experience to learn how to apply PM concepts to messy problems.
CF Action/ PM J Action	CF Action was higher than PM J Action.	**Theme 6.1:** Participants executed flexible thought more frequently than they executed PM judgment.	PM J Actions were more difficult than CF Actions because they required more complex thinking and the application of two PM concepts.
PM J Thought/ PM J Action	PM J Thought was higher than PM J Action.	**Theme 6.3:** Participants could not yet *apply* PM judgment because they were developing an *understanding* of basic PM concepts.	Participants, who had little to no prior PM experience, needed to develop lower-level cognition (*remembering and understanding*) before they can apply the concepts. Participants with more experience in PM may learn different things from the progressive case.

of flexible thought in the early phase of the course. First, it is possible that it took participants some time to learn how to execute CF in a new context (e.g., moving from ID to PM). Second, when participants minimized the first zinger, it may have impacted their ability to execute CF. Third, it is possible that differences in CF Action are due to the nature of the zingers. Scope changes and schedule changes may prompt difference types of responses and are not equivalent. It appears that novices with little to no prior PM experience can learn PM concepts rather quickly; however, it takes time to apply the concepts to messy problems.

Threats

The progressive case was a part of an online, PM class within ID PD. Since the course was constrained by the university's semester dates, the progressive case was about ten weeks long. This may not be enough time to develop flexible thinking and project management judgment in novices. However, this threat is not unique to this dissertation study; other CBM literature face similar constraints (E. Choi et al., 2014). A strength of this dissertation study is that CF and PM J were measured using a time-series so growth, rather than end-state, could be considered.

Research in educational settings are threatened when participants are not motivated to participate in the activities. For example, the progressive case was lower stakes than a real work project. Participants may have not given the progressive case or their responses to the zingers enough importance. This would reduce the number of Strong codes, especially Action codes. Also, since some of the data were collected and analyzed on a team-level, it may be hard to tell if every member of the team was thinking and acting with CF and PM judgment. However, when the researcher watched the recordings of two teams' (Team A and Team D) virtual sessions, it appeared that all participants were fully engaged in the activity and were motivated to deliver high-quality work.

The data analysis framework was developed to distinguish between CF and PM judgment. However, sometimes, exhibiting PM judgment affects CF and vice versa. For example, minimizing the effect of an unexpected event is good PM practice and is coded as Strong PM J. However, this decreases Action codes because participants no longer need to make edits to their PM plans, balance constraints, or ripple changes. This was addressed by providing rich descriptions of how teams made decisions and providing examples of participants' work.

To provide a rich case study using CSRM, data were analyzed and presented in many ways. The results and themes discussed in this chapter are based overall Level 1 code trends, which include all individual and team-level data in the dissertation study. Thus, this chapter is more inclusive of what *all* participants thought and did during the class. Yet, looking at Level 1 code trends of only the teams who were selected for full data analysis (Table 21) provides additional detail on what was going on as they engaged in a dynamic problem. For example, Team A and Team B's CF Action and PM J Action distributions flip-flopped over time and Team D never exhibited PM J Action throughout the dissertation study. These trends are less visible when overall results and trends are presented.

The researcher planned to ask participants about the impact of the progressive case on their learning experience on the final exam. Unfortunately, these data were missing from the course. While the researcher removed a research question from the dissertation study, it still provides a rich description of how participants engaged in a progressive case by tracking their *thoughts and actions* over time.

Since this dissertation study involves the implementation of a piece of instruction, the results are context-bound (Richey & Klein, 2007). Some of the conclusions and "lessons learned" may be applicable to those working on similar projects with similar learners (Richey & Klein, 2007). Future research could investigate the use of progressive case studies in different contexts and domains to create generalizable theories (Yin, 2018).

Future Research

This dissertation study aimed to describe the learning process by tracking participants' CF and PM judgment in thought and action dimensions while they engaged in a dynamic problem. The results may inform the design of instruction, such as CBM designs, to prepare novices to respond to unexpected events and solve messy problems in the workplace. This was not an intervention study. Future research could use comparative or experimental methods to investigate the impact of a progressive case as an intervention. Research questions may include:

1. Do participants learning with progressive cases develop more CF than participants learning with static cases?
2. Do participants learning with progressive cases develop more PM judgement than participants learning with static cases?

Future research may also replicate this dissertation study in other PM courses to increase the generalizability of the results. Also, since almost every workplace deals with unexpected events and *messy* problems, this dissertation study could be replicated in many different contexts, such as medical and business PD. The researcher could still track CF as it was defined and operationalized here. However, the researcher would need to define and operationalize what good and bad judgment is within the new domain. Studies conducted in different contexts may utilize different zingers to make the unexpected events more relevant and realistic for the domain. For example, zingers in a medical context may include shortages of medical supplies, false positives, or faulty equipment.

This dissertation study included two zingers. In the first zinger, the client requested additional deliverables (e.g., increased scope) from the participants. In the second zinger, the client requested that the product be delivered sooner (e.g., decreased time). The order of these zingers was intentional. Scope changes may be more likely to occur early in project planning, while schedule changes may be more likely to occur late in the project. Thus, the order of the zingers was realistic. However, it is possible that the zingers prompt different types of responses and cannot be compared. A replication study could switch the order of the zingers to identify if it makes a difference.

Most of the participants in this dissertation study were novices with little to no prior PM experience. Literature suggests that individuals' developmental levels can impact what they learn from the same piece of instruction (Rumeser & Emsley, 2019; Savelsbergh et al., 2016; Sharma et al., 2019). Future research could compare novices and experts' thoughts and actions within a progressive case. Research questions may include:

1. How do novices respond to unexpected events during a progressive case?
2. How do experts respond to unexpected events during a progressive case?
3. What are the similarities and differences between the responses of novices and experts during a progressive case?

Similar comparative research questions could be used to investigate if participants' characteristics, such as background and demographics, impact their learning experiences and outcomes during progressive cases.

Investigating how experts respond to zingers may help researchers develop more detailed data analysis frameworks. This dissertation study utilized a dichotomous scale to evaluate the quality of participants' responses (e.g., strong and weak). This was done because PM literature did not provide enough support to distinguish between good, better, and best responses. However, if research looks at how experts respond to zingers, these responses may provide support to develop continuous scales to evaluate the quality of participants' thoughts and actions.

Modifications to the course design affect participants' CF and PM judgement in thought and action dimensions. For example, researchers can look at the impact of scaffolds (ex. hints, examples, and instructor feedback) on the development CF and PM judgement during progressive cases. Also, researchers can add details to the case (ex. more specifics on the budget and the cost of resources) and see if that affects the assumptions participants make about the case and the zingers.

Future research can take similar approaches to track participants' *thoughts and actions*, rather than measuring learners' perceptions and attitudes which are less relevant to the transfer of skills. In their analysis of prior research on serious PM games, Rumeser and Emsley (2019) wrote: "Although most of the games in the literature simulate decision-making activities, none of these games measures how decisions are improved when playing the games" (p. 25). While literature that measures perceived learning and attitudes can contribute to our understanding, it creates a gap between "what is true in the *real world* (i.e., the importance of decision-making skill in managing complex projects) and what is true in the *serious game world"* (Rumeser & Emsley, 2019, p. 25). In other words, studies that measure perceived learning and attitudes are one step removed from the real-world phenomena. This dissertation study adds value by measuring how participants thought about a complex situation and what they decided to do to respond to realistic challenges.

Implications

Forbes compiled a list of the top 15 skills workers will need in 2020 and beyond (Beckford, 2020). This dissertation study touches on five of these—including the top three: complex problem solving (#1); critical thinking and analysis (#2); judgment, reasoning, analytical thinking, and decision making (#3); cognitive flexibility (#10); and active learning and learning strategies (#11). Instructional designers will need guidance on how to design low-cost and low-barrier-of-entry learning experiences to develop these skills in novices and practitioners. Since CSRM is "generalizable to theoretical propositions" (Yin, 2018, p. 20), the findings of this dissertation study and replication studies may inform instructional theories around training for the development CF and judgment.

The recent COVID pandemic has confirmed that *many workers in many contexts* need to be trained to respond to unexpected events. This dissertation study may provide support for low-cost CBM designs that engage learners in dynamic problems that resemble real-work conditions. While the participants in this dissertation study may have needed more time to learn how to *apply* their new skills, some responses on the final exam demonstrate that they became more *aware* that changes occur in a project:

> *Quote 1:* Lastly, the project management plan made me realize that flexibility is a vital characteristic of a project manager. Flexibility means the project manager can assign works reasonably, deals with unexpected situations well and change the initial plan according to those unexpected circumstances. Since the project will not be implemented 100 percent according to the original plan, the project manager should adjust their plan to make sure the project can be finished on time. *(Final Exam, Participant 2)*

> *Quote 2:* Project managers are problem solvers. There will be problems during a project. There has never been a project that has gone just as planned. People may leave the project, people you rely on may not complete their task on time or as a whole. Good

> project managers will handle problems and help the project continue on the right path. *(Final Exam, Participant 11)*

Thus, while a short progressive case may not be *sufficient*, it can still contribute to preparing practitioners for changes in their workplaces.

This dissertation study also provides a model on how to investigate learners' experiences by tracking their *thoughts and actions,* rather than relying on learners' perceptions which are one-step removed from the phenomenon. ID researchers may use similar qualitative methods to describe *how* learning is happening, rather than measuring learners' perceptions.

Practical Recommendations for Instructional Design and Project Management Professional Development

The results suggest that when novices are engaged in authentic and *messy* problems, they develop thinking strategies before practice strategies. Engaging students in CBM designs that emphasize discussion and reflection may yield only lower levels of cognition (ex. remembering and understanding) leaving novices ill-prepared to execute their new skills to develop tangible solutions in the workplace. Also, assessing learners' thoughts about a case or relying on their perceptions may inflate measures of competence and work-readiness. Therefore, ID PD and PM PD may consider:

- *Requiring learners to develop a tangible solution* for the case problem rather than just engaging in a discussion. This will give learners an opportunity to experiment with some practice strategies. This study suggests that practice strategies are difficult for novices to develop; instructors may need to scaffold and provide developmental feedback. Since this type of instruction makes learners' thinking more visible, instructors can discuss and provide feedback on their actions as well as their thoughts.

- *Introducing realistic, unexpected events into course assignments* to help learners become more aware of what may happen in the workplace.
  - This can be done using low-cost, low-barrier-of-entry methods, such as conference calls and email. These methods are also more authentic than simulations and games because they are what novices will experience in the workplace.
- *Assessing learners' thoughts and actions* during dynamic learning experiences. By assessing learners on higher-order cognitive tasks (ex. applying, evaluating), they are held accountable for developing the practice strategies they need to be work-ready.

Conclusion

"Instructional designers will need to…[be] able to make rapid, flexible decisions that are aligned with a broad range of organizational needs"

(Slagter van Tryon et al., 2018, p. 149).

Work readiness is "the extent to which graduates are perceived to possess the skills and attributes that render them prepared for success in the workplace" (Borg & Scott-Young, 2020, p. 166). More simply, it is a measure of how well novices can transfer the knowledge and skills they learned during PD to their work. In a recent study, Borg and Scott-Young (2020) compared curricula from Australian PM undergraduate programs with a PM work readiness framework written by the Business Council of Australia. None of the programs trained novices on two work-readiness values: flexibility and adaptability. "The absence of these competencies may not only pose negative impacts on graduates' university-to-work transitions, but may also hinder their ongoing career development" (Borg & Scott-Young, 2020, p. 174).

This dissertation study aimed to inform the design of instruction to develop the expert-like thinking strategies and practice strategies required to respond to unexpected events and solve messy problems. Much of the learning experiences in PD are *neatened* (Spiro et al., 1987), leaving novices ill-prepared for the complexity of real-world practice. Engaging novices in progressive cases that include realistic and unexpected events may make them more work ready.

This dissertation study *described* the learning process while participants engaged in a dynamic problem within a progressive case. Using CSRM and time-series analysis, participants' levels of CF and PM judgment were tracked in *thought* and *action* dimensions over time.

In general, the selected teams approached the zingers differently. In most cases, teams made optimistic assumptions, did not balance constraints, and submitted PM plans with internal inconsistencies. While teams had difficulty executing responses to unexpected changes on their PM plans, they exhibited flexible thinking and an understanding of PM concepts in their reflections and discussions. Thus, participants demonstrated more CF than PM judgment, and their *thoughts* exhibited more CF and PM judgment than their *actions*.

The results suggest:

- Participating in a progressive case helped some novices become aware of the dynamic nature of PM work.
- Novices' assumptions can affect what they think, do, and/or learn during a progressive case.
- CF is a thinking strategy that can be transferred across contexts and domains (Krems, 1995). However, learning how to execute CF in a new context might take time.
- Novices can learn PM concepts rather quickly; however, it takes time to learn how to apply the concepts to *messy* problems.

Appendix A: Worksheet Questions

The zinger was restated on the worksheet:

Zinger 1: As your client on this Project management Project, I have returned from a professional development conference and was introduced to a new technology— and I want it incorporated into the design steps of this project. I am convinced that this multimedia element can be used in ways to present the instructional content in a very engaging ways. My question to you is .. since you have already been working on the project management plan for this project, how will this affect the project plan and what will be the impact of the plan at this point if I want it added...how do you advise me on this change in specification?

Zinger 2: The client gives you a call and explains that the timeline for the project has changed. His manager is demanding that the work be done quicker. They need the deliverable 20% ahead of schedule (e.g. if your plan was originally 20 weeks long, it needs to be adjusted to 16 weeks).

Rest of the worksheet was consistent for zinger 1 and zinger 2:

Collaborate with your team for 10 minutes and respond to the questions below... then come back to the meeting a discuss with me...

TYPE your Team member names below: then...

Respond to QUESTION 1: What do you think the client is asking you to do? ***(hint: remember you are NOT designing instruction, you are developing a plan to help the client manage the project)***

Respond to QUESTION 2: What assumptions are you making about this new idea / request in terms of its affects on your project management plan?

Respond to QUESTION 3: Imagine how this modification will affect your project plan... Describe briefly how this will affect your plan and what implications it might have for the project? ***(hint: time line, human resources, etc.)***

Respond to QUESTION 4: What are the possible ways your team can incorporate this new idea into the plan, even if you do not think it is a good idea? ***(hint: tasks, human resources, project scope, project quality)***

[NOTE: After a discussion with the instructor and this Video Conference has ended, your team, will choose your solution(s) to this new idea and revise the templates you just drafted. Think about the questions you responded to on this worksheet and your discussion to follow. Think about how the new idea changed your plan, or not. Then, incorporate your ideas in the templates we just discussed, and as appropriate into the next set of templates, or final report and presentation.

See the DROPBOX for further instructions on how to indicate template modifications BEFORE you POST the updated templates to the DROPBOX. Your Updated Templates are due the day BEFORE the Final Project Management Report is due

Appendix B: Final Exam Questions used in the Dissertation Study

1. What are the three most important characteristics of a 'good' project manager? (Provide a short description of each characteristic and rationale for each is important to a project manager.) Type your responses below .. For each of the THREE be sure to include..
    a. Important characteristic of a project manager:
    b. short description of this characteristic:
    c. rationale for why this is an important characteristic:

2. Which 2 phases of project management are the most important in making a project successful? Provide a rational for your response.

3. During the Virtual Sessions new requirements for the project plan were given to your team. These may have slightly or significantly affected your project management plan, or not. Please briefly describe (i) each new requirement and (ii) how your team modified the project management plan to meet this requirement. Also describe your (iii) assumptions about the new requirement and (iv) why you believe your changes helped to create a more accurate plan. Respond below...

    (i) What was the new requirement
    (ii) What were your assumptions about this new requirement? (e.g., affects team skills, project timing, multiple parts of the plan)
    (iii) What were the changes made to the components of the project management plan? (Be specific, e.g., added tasks, changed time line)
    (iv) Why do you think this change met the needs of the new requirement?

    You should describe TWO requirement changes given to your team... be sure to label the changes A and B and include the numbers above (i, ii, iii, iv) to indicate your response to each part of the exam question.

Appendix C: Example Case Study Scenario

IDE 761 – Strategies in Educational Project Management

CASE: Athletic Skills Training Project Management Plan

Your team's role is to interpret and use these data to create a project management plan for this case.

THE CASE INTRODUCTION

Your team is to create the most effective, efficient, and inclusive plan to accomplish the client's goals. The client is coaching staff at a top tier university (***your team can pick the sport***).

The coaching staff has noticed, and verified through evidence, that student athletes (especially freshman and transfer students) are not meeting expectations in terms of attending the combination of scheduled athletic activities and academic courses required to maintain student athlete status.

Upon further investigation during a front end analysis process, it was determined that new student athletes lacked the knowledge, skills, and attitudes to meet these requirements.

The coaching staff decided to create an instructional program to help close this gap and make sure that new student athletes know and follow requirements. It was determined that the focus of the program will be on ***time management*** and ***criticality of meeting athletic and academic requirements***. A variety of techniques will be used in the instruction including lectures, video clips, hands-on practice activities, site visits, and follow-up. The instructional sessions will be part of the first two weeks of student athlete orientation programs, followed by several check points throughout the first semester to ensure students have mastered the concepts and are complying with requirements.

The instruction has been designed and approved by the coaching staff, however the team ***needs a project management plan*** to meet its aggressive ideas to develop and implement the instructional solutions at the beginning of the next academic year.

THE PROBLEM / PROPOSED SOLUTION

Performance Problem: Students athletes, especially freshman and transfer students, are missing classes, study sessions, and are sometimes late for workout/exercise and athletic practice sessions.

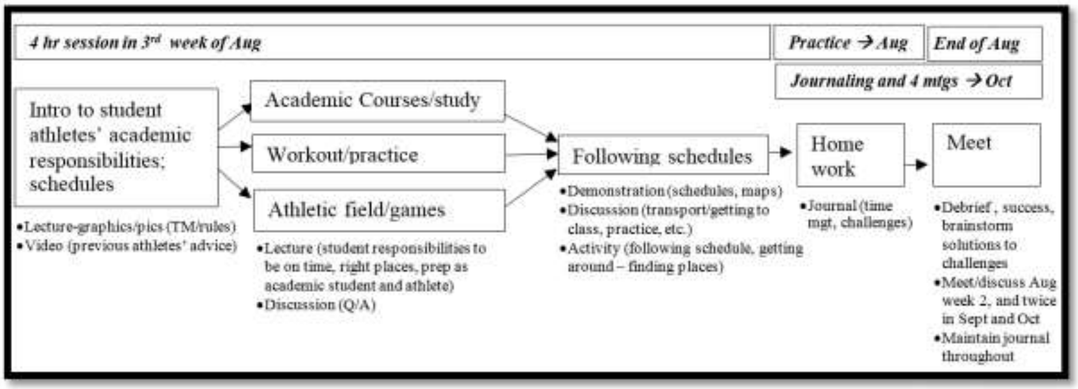
They appear to have difficulty reading their schedules and managing their time between academic, athletic, and social activities and getting around campus in efficient ways.

This may be affecting their academic standings and their potential to be successful athletes. This performance problem is attributed to lack of knowledge and skills in time management and reading transportation schedules (bus schedules that go between housing, sporting facilities and academic buildings). It was also determined that some student athletes have the attitude that getting to workout, study, and class sessions on-time is not that important. They often do not understand the consequences that doing poorly in classes and consistently being late may have on their academic and athletic standings.

Proposed Instructional Solution: In consultation with an instructional designer, the coaching staff decided to create instruction to help student athletes enhance their knowledge skills, and attitudes on athletic and academic requirements.

The focus of the program will be time management and criticality of getting to both athletic and academic sessions on time and participating actively in both. The instructional program is planned to run during the last two weeks of the summer semester within the allotted athletic schedule of 24 hours meeting time each week. This program will take 4 hours of meeting time in each of two weeks. The work to develop this project will begin in the spring (January) and implementation will be in the summer (August) with follow-up and evaluation throughout the first two months (September and October). See diagram below for illustration of instructional solution and high level implementation plan.

IDE 761 – Strategies in Educational Project Management
CASE: Athletic Skills Training Project Management Plan
Page 2 of 3



PERSONNEL RESOURCES AVAILABLE
You will have the following personnel available to work on this project:

Instructional Design Team Specialists (available as required throughout the project)

Instructional Designer(s) – *design/develop instructional materials, learning assessment*
Program evaluation specialists – *design, develop, implement, analyze evaluations*
Videographers – *create scripts, shoot video, edit video*
Graphic artists – *create graphic images, advise on graphic design and use of visuals*
Educational technology/programmers – *web and technology-based site and resources*
Educational Project Manager – *specialist in managing educational/ID projects*

Coaching / Athletic Staff (note time limits of various staff)

Head Coach – *sponsor, very limited time, only for occasional ½ hour key reviews/sign off*
Assistant Coach – *limited time, subject matter expertise: practice/workout/team meeting requirements; an Assist. Coach will facilitate instruction with a Student Athlete Academic Counselor*
Student Athlete Academic Counselor – *subject matter expertise: academic schedules, resources, etc.*
On-campus NCAA policy expert - *very limited time, expert on NCAA policies*
Junior and Senior Student Athletes (multiple) – *limited time, based on schedules*

OTHER RESOURCES AVAILABLE
The following other resources are available for this project:

- Access to online resources for supporting instruction (e.g., blackboard site)
- Access of digital cameras, video equipment, etc.
- Full access to academic and athletic facilities available to student athletes (e.g., class rooms, study areas, team meeting rooms, practice facilities, workout facilities etc.)
- Full access to university resources for student athletes (e.g., maps, schedules, handbook, NCAA policies, campus transportation schedules)
- Printing resources to create paper-based materials
- Data analysis resources to analyze evaluative data

A pre-agreed amount of funding is available to support non-coaching/athletic program personnel, e.g., ID team and resources deemed essential for the project. Coaches and athletic students are allocated to the project based on their workload. No pay is allocated to student athletes involved in development of facilitation of this instruction. Their time will be negotiated as part of service requirements –student athlete time commitment in supporting project development should be kept to a minimum.

IDE 761 – Strategies in Educational Project Management

CASE: Athletic Skills Training Project Management Plan

OTHER ASSUMPTIONS

Assumptions: The assumptions below are likely to affect the project management plan:

- Weather related issues can cause power outages and transportation issues between January and March
- The coaches may have time conflicts, participation in project activities must be flexible
- Senior student athletes have the maturity and routines to make good role models and mentors to new athletes
- This program must start at planned time

As your team works through the development of this Educational Project Management Plan you may have to make other assumptions. Your team should make reasonable assumptions based on the case and then document these as part of the project management plan proposal and reporting.

YOUR GOAL

Client's Request: The coaching staff has asked for help to create an educational project management plan to develop and implement the instructional solution over the next summer, fall, and spring semesters.

Your Project Goal: Create the most effective, efficient, and inclusive plan to accomplish the client's goals. (***your team can pick the sport***).

Requirements: Create a Project Management Plan (PMP) and 10 minute presentation to support the design, development, implementation, and evaluation of this instructional solution. You can assume a thorough needs analysis was completed, however a review of the complete analysis and design solution should be completed prior to starting the development process. Your PMP report and presentation should include sections on:

- **EXECUTIVE SUMMARY:** Summary of PMP (front of report, 1-page)
- **DEFINE:** Project charter (statement of case project goals, required tasks, stakeholders affected, resources available, deliverables, assumptions, risks)
- **PLAN:** Project plan (sequenced list of critical tasks noting responsible person, critical path [work breakdown structure, Gantt chart])
- **ORGANIZE:** Project organization (structure, stakeholders and their roles, team organization, leadership qualities)
- **CONTROL:** Project management plan (work packets; communication & conflict resolution strategies, status reporting, quality guides, contingencies)
- **CLOSE:** Project closing plan (checklist of final deliverables, sign-off procedures, project debrief, final reporting based on initial goals)

Appendix D: Template for PM Plan

Project Management Plan Outline/Template

IDE 761

INSTRUCTIONS: Your final Report for this course should be written in the format described below. Each team should prepare ONE report on their given case study. ALL team members should post the final project to their own dropbox (all team members post the SAME report using the file naming convention listed below).

NOTE: When you identify the project tasks you should create a draft of your task list that identifies ALL the critical tasks required. When you create the accompanying Gantt charts, variance tools, etc. for inclusion in the report, you only need to provide a partial example of your tasks to demonstrate that you know what the tool is and how to create the tool for your specific project. **In other words, DO NOT develop these project management tool for the entire project, rather only for a sample of the activities**.

PROJECT REPORT FRONT MATTER (3 pages)

- Cover page with team names
- Executive Summary with graphic representation of project
- Table of content

PLANNING THE PROJECT (3 pages)… DEFINE

- Project charter with problem/opportunity; project goals; project objectives; success criteria;
- assumptions and risks

PLANNING THE PROJECT (3 pages)… PLAN

- Project plan with sequenced list of tasks (WBS)
- Tasks are on a schedule (e.g., critical path, Gantt)
- Project plan with executive summary, definition, plan

This section should include WBS, Project Network, Critical Path, and Project Proposal statement. A detailed WBS/Time line may be included in Appendix B. Max 2 pages.

IMPLEMENTING THE PROJECT (3 pages)… ORGANIZE

- Project organization chart and reporting structure
- Describe recruiting criteria for personnel needs, including leadership qualities
- Define and assign work packages

This section should include recruiting criteria, work package descriptions, work package assignments. Detailed materials may be included in Appendix C. Max 2 pages each.

IMPLEMENTING THE PROJECT (2 pages)… CONTROL

- Define management style (refer to requirements for project manager and team members)
- Describe management tools tools (e.g., status reporting, variance reports, change requests)
- Describe communication, conflict resolution, and contingency planning strategies

IMPLEMENTING THE PROJECT (2 pages)… CLOSE

- Project closing plan on how to obtain client acceptance (define criteria and process) and install deliverables (define final deliverable requirements)
- Describe template for final project report, based on initial goals
- Create final deliverable checklist and sign-off procedures
- Outline post-project debrief audit (define criteria)

APPENDIX A (up to 2 pages)… REFERENCES for all content and graphics!
APPENDICES B & C (up to 2 pages each) … use as necessary

TOTAL: up to 20 pages with appendices
FORMAT: 12 pt font, Times New Roman, single spaced, 1" margins, page numbering (Page # of #). The final report should be ONE document in pdf file.
Include ALL team members' last names in the file name (IDE761-Smith-Wu-James-Hacky_PrjMgtPlan)

Appendix E: IRB

SYRACUSE UNIVERSITY

INSTITUTIONAL REVIEW BOARD
MEMORANDUM

TO: Tiffany Koszalka
DATE: February 19, 2018
SUBJECT: **Amendment for Exempt Protocol**
AMENDMENT#: 1- A) Addition of Research Staff (Lina Souid & Yuri Pavlov)
IRB #: 17-017
TITLE: *A Study of Online Learning Resources*

Your current exempt protocol has been re-evaluated by the Institutional Review Board (IRB) with the inclusion of the above referenced amendment. Based on the information you have provided, this amendment is authorized and continues to be assigned to category **1**. This protocol remains in effect from **February 1, 2017** to **January 31, 2022**.

CHANGES TO PROTOCOL: Proposed changes to this protocol during the period for which IRB authorization has already been given, cannot be initiated without additional IRB review. If there is a change in your research, you should notify the IRB immediately to determine whether your research protocol continues to qualify for exemption or if submission of an expedited or full board IRB protocol is required. Information about the University's human participants protection program can be found at: http://orip.syr.edu/human-research/human-research-irb.html Protocol changes are requested on an amendment application available on the IRB web site; please reference your IRB number and attach any documents that are being amended.

STUDY COMPLETION: The completion of a study must be reported to the IRB within 14 days.

Thank you for your cooperation in our shared efforts to assure that the rights and welfare of people participating in research are protected.

Tracy J. Cromp

Tracy Cromp, M.S.W.
Director

DEPT: Instructional Design, Development & Evaluation, 264 Huntington Hall

STUDENT: Mary Wilhelm-Chapin ; Yuri Pavlov
Lina Souid

References

About us. (2019). Harvard Business Publishing. https://hbsp.harvard.edu/about-us/

Abrami, P. C., Bernard, R. M., Bures, E. M., Borokhovski, E., & Tamim, R. M. (2011). Interaction in distance education and online learning: Using evidence and theory to improve practice. *Journal of Computing in Higher Education*, *23*(2–3), 82–103. https://doi.org/10.1007/s12528-011-9043-x

Andersen, E. S. (2016). Do project managers have different perspectives on project management? *International Journal of Project Management*, *34*(1), 58–65. https://doi.org/10.1016/j.ijproman.2015.09.007

Andrews, D. H., Hull, T. D., & Donahue, J. A. (2009). Storytelling as an instructional method: Descriptions and research questions. *The Interdisciplinary Journal of Problem-Based Learning*, *3*(2), 6–23. https://doi.org/10.7771/1541-5015.1063

Aram, E., & Noble, D. (1999). Educating prospective managers in the complexity of organizational life. *Management Learning*, *30*(3), 321–342. https://doi.org/10.1177/1350507699303004

Archer, S., Eyster, J. P., Kelly, J. J., Kowalski, T., & Shanahan, C. F. (2014). Reaching backward and stretching forward: Teaching for transfer in law school clinics. *Journal of Legal Education*, *64*(2), 258–297. http://heinonline.org/hol-cgi-bin/get_pdf.cgi?handle=hein.journals/jled64&section=26

Ashleigh, M., Ojiako, U., Chipulu, M., & Wang, J. K. (2012). Critical learning themes in project management education: Implications for blended learning. *International Journal of Project Management*, *30*(2), 153–161. https://doi.org/10.1016/j.ijproman.2011.05.002

Bannan-Ritland, B. (2001). Teaching instructional design: An action learning approach.

Performance Improvement Quarterly, *14*(2), 37–52. https://doi.org/10.1111/j.1937-8327.2001.tb00208.x

Banning, K. C. (2003). The effect of the case method on tolerance for ambiguity. *Journal of Management Education*, *27*(5), 556–567. https://doi.org/10.1177/1052562903252652

Barnes, L. B., Christensen, C. R., & Hansen, A. J. (1994). *Teaching and the case method* (3rd ed.). Harvard Business Review Press.

Beckford, A. (2020, July). The skills you need to succeed in 2020 and beyond. *Forbes*. https://www.forbes.com/sites/ellevate/2020/07/02/the-skills-you-need-to-succeed-in-2020-and-beyond/#29e76c913318

Benedict, N. (2010). Virtual patients and problem-based learning in advanced therapeutics. *American Journal of Pharmaceutical Education*, *74*(8), 1–5. https://doi.org/10.5688/aj7408143

Bennatan, E. M. (2000). *On time and within budget: Software project management practices and techniques* [Skillsoft] (3rd ed.). John Wiley & Sons. https://libezproxy.syr.edu/sso/skillport?context=2294

Bennett, S. (2010). Investigating strategies for using related cases to support design problem solving. *Educational Technology Research and Development*, *58*(4), 459–480. https://doi.org/10.1007/s11423-009-9144-7

Berggren, C., & Söderlund, J. (2008). Rethinking project management education: Social twists and knowledge co-production. *International Journal of Project Management*, *26*(3), 286–296. https://doi.org/10.1016/j.ijproman.2008.01.004

Bernard, R. M., Abrami, P. C., Borokhovski, E., Wade, C. A., Tamim, R. M., Surkes, M. A., & Bethel, E. C. (2009). A meta-analysis of three types of interaction treatments in distance education. *Review of Educational Research*, *79*(3), 1243. https://doi.org/10.3102/0034654309333844

Biafore, B., & Stover, T. (2012). *Your project management coach: Best practices for managing projects in the real world* [Skillsoft]. John Wiley & Sons. https://libezproxy.syr.edu/sso/skillport?context=46286

Bjorvatn, T., & Wald, A. (2018). Project complexity and team-level absorptive capacity as drivers of project management performance. *International Journal of Project Management*, *36*(6), 876–888. https://doi.org/10.1016/j.ijproman.2018.05.003

Borg, J., & Scott-Young, C. M. (2020). Priming the project talent pipeline: Examining work readiness in undergraduate project management degree programs. *Project Management Journal*, *51*(2), 165–180. https://doi.org/10.1177/8756972820904220

Boyne, S. M. (2012). Crisis in the classroom: Using simulations to enhance decision-making skills. *Journal of Legal Education*, *62*(2), 311–322. http://www.jstor.org/stable/42894285

Butt, A., Naaranoja, M., & Savolainen, J. (2016). Project change stakeholder communication. *International Journal of Project Management*, *34*(8), 1579–1595. https://doi.org/10.1016/j.ijproman.2016.08.010

Cennamo, K. S., & Kalk, D. (2005). Systematic and systemic design of instruction as an iterative process: A functional model for practice in the real world. *Educational Technology*, *45*(3), 40–48. https://www.jstor.org/stable/44429210

Charlebois, S., & Foti, L. (2017). Using a live case study and co-opetition to explore sustainability and ethics in a classroom: Exporting fresh water to China. *Global Business Review*, *18*(6), 1400–1411. https://doi.org/10.1177/0972150917713086

Chia, R. (1997). Process philosophy and management learning: Cultivating "foresight" in management education. In J. Burgoyne & M. Reynolds (Eds.), *Management learning: Integrating perspectives in theory and practice* (pp. 71–88). Sage Publications Ltd. https://doi.org/10.4135/9781446250488.n5

Choi, E., Lindquist, R., & Song, Y. (2014). Effects of problem-based learning vs. traditional lecture on Korean nursing students' critical thinking, problem-solving, and self-directed learning. *Nurse Education Today*, *34*(1), 52–56. https://doi.org/10.1016/j.nedt.2013.02.012

Choi, I., & Lee, K. (2009). Designing and implementing a case-based learning environment for enhancing ill- structured problem solving: Classroom management problems for prospective teachers. *Educational Technology Research and Development*, *57*(1), 99–129. http://www.jstor.org/stable/25619959

Cicmil, S., & Gaggiotti, H. (2018). Responsible forms of project management education: Theoretical plurality and reflective pedagogies. *International Journal of Project Management*, *36*(1), 208–218. https://doi.org/10.1016/j.ijproman.2017.07.005

Cicmil, S., Williams, T., Thomas, J., & Hodgson, D. (2006). Rethinking project management: Researching the actuality of projects. *International Journal of Project Management*, *24*(8), 675–686. https://doi.org/10.1016/j.ijproman.2006.08.006

Collins, A., Brown, J. S., & Holum, A. (1991). Cognitive apprenticeship: Making thinking visible. *American Educator*, 1–18. http://learnpbl.com/wp-content/uploads/2011/03/Cognitive.pdf

Conradi, E., Kavia, S., Burden, D., Rice, A., Woodham, L., Beaumont, C., Savin-Baden, M., & Poulton, T. (2009). Virtual patients in a virtual world: Training paramedic students for practice. *Medical Teacher*, *31*(8), 713–720. https://doi.org/10.1080/01421590903134160

Cooper, K. G., & Reichelt, K. S. (2004). Project changes: Sources, impacts, mitigation, pricing, litigation, and excellence. In P. W. G. Morris & J. K. Pinto (Eds.), *Wiley guide to managing projects* [Knovel] (pp. 743–772). John Wiley & Sons. https://app.knovel.com/hotlink/pdf/id:kt0047B3WE/wiley-guide-managing/project-changes-sources

Córdoba, J.-R., & Piki, A. (2012). Facilitating project management education through groups as systems. *International Journal of Project Management*, *30*(1), 83–93. https://doi.org/10.1016/j.ijproman.2011.02.011

Crawford, C. (2004). Non-linear instructional design model: Eternal, synergistic design and development. *British Journal of Educational Technology*, *35*(4), 413–420. https://doi.org/10.1111/j.0007-1013.2004.00400.x

Crawford, L. (2005). Senior management perceptions of project management competence. *International Journal of Project Management*, *23*(1), 7–16. https://doi.org/10.1016/j.ijproman.2004.06.005

Crawford, L., Morris, P., Thomas, J., & Winter, M. (2006). Practitioner development: From trained technicians to reflective practitioners. *International Journal of Project Management*, *24*(8), 722–733. https://doi.org/10.1016/j.ijproman.2006.09.010

Creswell, J. W. (2011). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Phi learning Pvt.

Culpin, V., & Scott, H. (2012). The effectiveness of a live case study approach: Increasing knowledge and understanding of ‘hard’ versus ‘soft’ skills in executive education. *Management Learning*, *43*(5), 565–577. https://doi.org/10.1177/1350507611431530

Dabbagh, N., & Dass, S. (2013). Case problems for problem-based pedagogical approaches: A comparative analysis. *Computers and Education*, *64*(May 2013), 161–174.

https://doi.org/10.1016/j.compedu.2012.10.007

Dainty, A., Cheng, M., & Moore, D. (2005). A comparison of the behavioral competencies of client-focused and production-focused project managers in the construction sector. *Project Management Journal*, *36*(1), 39–48. https://doi.org/10.1177/875697280503600205

Davis, B., & Radford, D. (2014). *Going beyond the waterfall-Managing scope effectively across the project life cycle* [Knovel]. J. Ross Publishing, Inc. app.knovel.com/hotlink/toc/id:kpGBWMSEA5/going-beyond-waterfall/going-beyond-waterfall

Demetriadis, S. N., Papadopoulos, P. M., Stamelos, I. G., & Fischer, F. (2008). The effect of scaffolding students' context-generating cognitive activity in technology-enhanced case-based learning. *Computers & Education*, *51*(2), 939–954. https://doi.org/10.1016/j.compedu.2007.09.012

Dimitrov, D. (2020). *Software project estimation: Intelligent forecasting, project control, and client relationship management* [Skillsoft]. Apress. https://libezproxy.syr.edu/sso/skillport?context=147700

Dong, X., Du, X., & Qi, B. (2016). Conceptual knowledge influences decision making differently in individuals with high or low cognitive flexibility: An ERP study. *PLoS ONE*, *11*(8), 1–20. https://doi.org/10.1371/journal.pone.0158875

Doraiswamy, P., & Shiv, P. (2012). *50 top IT project management challenges*. Ely, Cambridgeshire: ITGP. http://search.ebscohost.com.libezproxy2.syr.edu/login.aspx?direct=true&db=e000xna&AN=571587&site=ehost-live

Doyle, W. (1990). Case methods in the education of teachers. *Teacher Education Quarterly*, *17*(1), 7–15. http://www.jstor.org/stable/23475063

Egginton, B. (2012). Realising the benefits of investment in project management training. *International Journal of Managing Projects in Business*, *5*(3), 508–527. https://doi.org/10.1108/17538371211235344

Ericsson, K. A., Prietula, M. J., & Cokely, E. T. (2007). The making of an expert. *Harvard Business Review*, *85*(7/8), 115–121. https://hbr.org/2007/07/the-making-of-an-expert

Ertmer, P. A., & Cennamo, K. S. (1995). Teaching instructional design: An apprenticeship model. *Performance Improvement*, *8*(4), 43–58.

Ertmer, P. A., & Russell, J. D. (1995). Using case studies to enhance instructional design education. *Educational Technology*, *35*(4), 23–31.

Ertmer, P. A., Stephich, D. A., Flanagan, S., Kocaman-Karoglu, A., Reiner, C., Reyes, L., Santone, A. L., & Ushigusa, S. (2009). Impact of guidance on the problem-solving efforts of instructional design novices. *Performance Improvement Quarterly*, *21*(4), 117–132. https://doi.org/10.1002/piq.20041

Ertmer, P. A., & Stepich, D. A. (2005). Instructional design expertise: How will we know it when we see it? *Educational Technology*, *45*(6), 38–43. http://www.jstor.org/stable/44429251

Ertmer, P. A., Stepich, D. A., York, C. S., Stickman, A., Wu, X. L., Zurek, S., & Goktas, Y. (2008). How instructional design experts use knowledge and experience to solve ill-structured problems. *Performance Improvement Quarterly*, *21*(1), 17–42. https://doi.org/10.1002/piq.20013

Eseryel, D. (2006). *Expert conceptualizations of the domain of instructional design: An investigative study on the deep assessment methodology for complex problem-solving outcomes* [Doctoral Dissertation, Syracuse University]. http://surface.syr.edu/idde_etd/5/

Fortney, K. S., & Yamagata-Lynch, L. C. (2013). How instructional designers solve workplace problems. *Performance Improvement Quarterly*, *25*(4), 91–109. https://doi.org/10.1002/piq.21130

Geraldi, J. G., Lee-Kelley, L., & Kutsch, E. (2010). The Titanic sunk, so what? Project manager response to unexpected events. *International Journal of Project Management*, *28*(6), 547–558. https://doi.org/10.1016/j.ijproman.2009.10.008

Geraldi, J. G., Maylor, H., & Williams, T. (2011). Now, let's make it really complex (complicated): A systematic review of the complexities of projects. *International Journal of Operations & Production Management*, *31*(9), 966–990. https://doi.org/10.1108/01443571111165848

Gil, N., & Tether, B. S. (2011). Project risk management and design flexibility: Analysing a case and conditions of complementarity. *Research Policy*, *40*(3), 415–428. https://doi.org/10.1016/j.respol.2010.10.011

Gillard, S., & Price, J. (2005). The competencies of effective project managers: A conceptual analysis. *International Journal of Management*, *22*(1), 48–53. http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:The+Competencies+of+Effective+Project+Managers+:+A+Conceptual+Analysis#0

Goel, V., & Pirolli, P. (1992). The structure of design problem spaces. *Cognitive Science*, *16*(3), 395–429. https://doi.org/10.1016/0364-0213(92)90038-V

Golich, V. L. (2000). The ABCs of case teaching. *International Studies Perspectives*, *1*(1), 11–29. https://doi.org/10.1111/1528-3577.00002

Graf, D. (1991). A model for instructional design case materials. *Educational Technology Research and Development*, *39*(2), 81–88. https://doi.org/10.1007/bf02298156

Graham, A. K., Morecroft, J. D. W., Senge, P. M., & Sterman, J. D. (1992). Model-supported case studies for management education. *European Journal of Operational Research*, *59*(1), 151–166. https://doi.org/10.1016/0377-2217(92)90012-X

Gray, C. M., Dagli, C., Demiral-Uzan, M., Ergulec, F., Tan, V., Altuwaijri, A. A., Gyabak, K., Hilligoss, M., Kizilboga, R., Tomita, K., & Boling, E. (2015). Judgment and instructional design: How ID practitioners work in practice. *Performance Improvement Quarterly*, *28*(3), 25–49. https://doi.org/10.1002/piq.21198

Grossman, P. L. (1992). Teaching and learning with cases: Unanswered questions. In J. H. Shulman (Ed.), *Case methods in teacher education* (pp. 227–239). Teachers College Press.

Guldemond, T. A., Hurink, J. L., Paulus, J. J., & Schutten, J. M. J. (2008). Time-constrained project scheduling. *Journal of Scheduling*, *11*(2), 137–148. https://doi.org/10.1007/s10951-008-0059-7

Hallgren, M., & Maaninen-Olsson, E. (2005). Deviations, ambiguity and uncertainity in a project-intensive organization. *Project Management Journal*, *36*(3), 17–26. https://doi.org/10.1177/875697280503600303

Hardré, P. L., Ge, X., & Thomas, M. K. (2006). An investigation of development toward instructional design expertise. *Performance Improvement Quarterly*, *19*(4), 63–90. https://doi.org/10.1111/j.1937-8327.2006.tb00385.x

Harrin, E. (2013). *Managing project scope: Shortcuts to success*. BCS, The Chartered Institute for IT. http://search.ebscohost.com.libezproxy2.syr.edu/login.aspx?direct=true&db=e000xna&AN=604669&site=ehost-live

Heagney, J. (2016). *Fundamentals of project management* [Knovel] (5th ed.). AMACOM – Book

Division of American Management Association. https://app.knovel.com/hotlink/toc/id:kpFPME0001/fundamentals-project/fundamentals-project

Hong, S., & Yu, P. (2017). Comparison of the effectiveness of two styles of case-based learning implemented in lectures for developing nursing students' critical thinking ability: A randomized controlled trial. *International Journal of Nursing Studies*, *68*(March), 16–24. https://doi.org/10.1016/j.ijnurstu.2016.12.008

Hudspeth, D., & Knirk, F. G. (1989). Case study materials: Strategies for design and use. *Performance Improvement Quarterly*, *2*(4), 30–41. https://doi.org/10.1111/j.1937-8327.1989.tb00420.x

Irby, D. M. (1994). Three exemplary models of case-based teaching. *Academic Medicine*, *69*(12), 947–953. http://www.bumc.bu.edu/facdev-medicine/files/2010/06/3-models-of-case-based-learning-irby.pdf

Ivory, C., & Alderman, N. (2005). Can project management learn anything from studies of failure in complex systems? *Project Management Journal*, *36*(3), 5–16. http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:CAN+PROJECT+MANAGEMENT+LEARN+ANYTHING+FROM+STUDIES+OF+FAILURE+IN+COMPLEX+SYSTEMS#0

Jaafari, A. (2003). Project management in the age of complexity and change. *Project Management Journal*, *34*(4), 47–57. https://doi.org/10.1177/875697280303400407

Jackson, G. (2011). Rethinking the case method. *Journal of Management Policy & Practice*, *12*(5), 142–164. http://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=78858330&site=ehost-

live

Jennings, D. (2002). Strategic management: An evaluation of the use of three learning methods. *The Journal of Management Development*, *21*(9/10), 655–665. https://doi.org/10.1108/02621710210441658

Jonassen, D. H. (1992). Cognitive flexibility theory and its implications for designing CBI. In S. Dijkstra, H. P. M. Krammer, & J. J. G. van Merriënboer (Eds.), *Instructional Models in Computer-based Environments* (pp. 385–403). Springer. https://doi.org/10.1007/978-3-662-02840-7_23

Jonassen, D. H. (2000). Toward a design theory of problem solving. *Educational Technology, Research and Development*, *48*(4), 63–85. https://doi.org/10.1007/BF02300500

Jonassen, D. H. (2008). Instructional design as design problem solving: An iterative process. *Educational Technology*, *48*(3), 21–26. http://www.jstor.org/stable/44429574

Jonassen, D. H., Dyer, D., Peters, K., Robinson, T., Harvey, D., King, M., & Loughner, P. (1997). Cognitive flexibility hypertexts on the web: Engaging learners in meaning making. In B. Khan (Ed.), *Web-based Instruction* (pp. 119–133). Educational Technology Publications.

Jonassen, D. H., & Hernandez-Serrano, J. (2002). Case-based reasoning and instructional design: Using stories to support problem solving. *Educational Technology Research and Development*, *50*(2), 65–77. https://doi.org/10.1007/BF02504994

Josephsen, J., & Butt, A. (2014). Virtual multipatient simulation: A case study. *Clinical Simulation in Nursing*, *10*(5). https://doi.org/10.1016/j.ecns.2013.12.004

Julian, M. F., Kinzie, M. B., & Larsen, V. A. (2000). Compelling case experiences: Performance, practice, and application for emerging instructional designers. *Performance Improvement Quarterly*, *13*(3), 164–201. https://doi.org/10.1111/j.1937-8327.2000.tb00181.x

Kelly, W. Q. (2016). *Competencies for instructional designers: A view from employers* (Document no. 10190299) [Doctoral Dissertation, Florida State University]. ProQuest Dissertations Publishing. https://search-proquest-com.erl.lib.byu.edu/docview/1873489041/fulltextPDF/AA23F352056A4EC8PQ/20?accountid=4488

Kennedy, M. M. (1990). Choosing a goal for professional education. In W. R. Houston, M. Haberman, & J. Sikula (Eds.), *Handbook of research on teacher education* (pp. 813–825). Macmillan.

Kerzner, H. (2001). *Project management: A systems approach to planning, scheduling, and controlling* [Knovel] (12th ed.). John Wiley & Sons. https://app.knovel.com/hotlink/toc/id:kpPMASAPSC/project-management-systems/project-management-systems

Kim, H., & Hannafin, M. J. (2008). Grounded design of web-enhanced case-based activity. *Educational Technology Research and Development*, *56*(2), 161–179. https://doi.org/10.1007/s11423-006-9010-9

Kim, S. M. (2015). How do we train instructional designers? Instructional design as negotiation. *Educational Technology*, *55*(4), 26–30. http://www.jstor.org/stable/44430386

Kliem, R. L. (2011). *Managing projects in trouble : Achieving turnaround and success* [Skillsoft]. Auerbach Publications. https://libezproxy.syr.edu/sso/skillport?context=46713

Koszalka, T. A., Russ-Eft, D. F., & Reiser, R. A. (2012). *Instructional designer competencies: The standards*.

Koszalka, T. A., Russ-Eft, D. F., Reiser, R. A., Canela, F. A. S., Grabowski, B. L., & Wallington, C. J. (2013). *Instructional designer competencies: The standards* (4th ed.). Information Age

Publishing, Inc. http://search.ebscohost.com.libezproxy2.syr.edu/login.aspx?direct=true&db=e000xna&AN=631679&site=ehost-live

Krathwohl, D. R. (2002). A Revision of Bloom's Taxonomy: An Overview. *Theory Into Practice*, *41*(4), 212–218. https://doi.org/10.1207/s15430421tip4104_2

Krems, J. F. (1995). Cognitive flexibility and complex problem solving. In P. A. Frensch & J. Funke (Eds.), *Complex problem solving: The European perspective* (pp. 201–218). Psychology Press.

Larson, M. B. (2005). Instructional design career environments: Survey of the alignment of preparation and practice. *TechTrends*, *49*(6), 22–32. http://link.springer.com/10.1007/BF02763727

Larson, M. B., & Lockee, B. B. (2009). Preparing instructional designers for different career environments: A case study. *Educational Technology Research and Development*, *57*(1), 1–24. http://www.jstor.org/stable/25619954

Laureiro-Martínez, D., & Brusoni, S. (2018). Cognitive flexibility and adaptive decision-making: Evidence from a laboratory study of expert decision makers. *Strategic Management Journal*, *39*(4), 1031–1058. https://doi.org/10.1002/smj.2774

Lee-kelley, L. (2018). When ' knowing what ' is not enough: Role of organised simulations for developing effective practice. *International Journal of Project Management*, *36*(1), 198–207. https://doi.org/10.1016/j.ijproman.2017.08.003

Luo, H. (2015). Applying the case-based method in designing self-directed online instruction [Doctoral Dissertation, Syracuse University]. In *Dissertations-ALL*. http://flagship.luc.edu/login?url=http://search.proquest.com/docview/1705570386?accounti d=12163%5Cnhttp://loyola-primo.hosted.exlibrisgroup.com/openurl/01LUC/01LUC_SERVICES?genre=dissertations+%26+theses&issn=&title=Applying+the+case-based+method+in+desig

Luo, H., Koszalka, T. A., Arnone, M. P., & Choi, I. (2018). Applying case-based method in designing self-directed online instruction: A formative research study. *Educational Technology Research and Development*, *66*(2), 515–544. https://doi.org/10.1007/s11423-018-9572-3

Macaulay, C. (2000). Transfer of learning. In V. E. Cree & R. Davidson (Eds.), *Transfer of learning in professional & vocational education: Handbook for social work trainers* (pp. 1–26). Routledge.

Maharaj, D. (2020). *The challenge of instructional designers to acquire technical skills to gain employment* (Document No. 27737088) [Doctoral Dissertation, Capella University]. Proquest. https://libezproxy-syr-edu.libezproxy2.syr.edu/login?url=https://www-proquest-com.libezproxy2.syr.edu/docview/2382068752?accountid=14214

Maley, C. H. (2012). *Project management concepts, methods, and techniques*. Auerbach Publishers, Incorporated. https://app.knovel.com/hotlink/pdf/id:kt011DWZKA/guide-project-management/standard-project-management

Martin, A. (2000). A simulation engine for custom project management education. *International Journal of Project Management*, *18*(3), 201–213. https://doi.org/10.1016/S0263-7863(99)00014-9

Martin, F., & Bolliger, D. U. (2018). Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment. *Online Learning*, *22*(1), 205–223. https://doi.org/10.24059/olj.v22i1.1092

Martin, M. M., & Rubin, R. B. (1995). A new measure of cognitive flexibility. *Psychological Reports*, *76*(2), 623–626. https://doi.org/10.2466/pr0.1995.76.2.623

Matta, N. F., & Ashkenas, R. N. (2003). Why good projects fail anyway. *Harvard Business Review*, *September*, 109–114.

McBride, M. (2013). *Managing projects in the real world: The tips and tricks no one tells you about when you start* [Skillsoft]. Apress. https://libezproxy.syr.edu/sso/skillport?context=59482

Merserth, K. K. (1992). Cases for decision making in teacher education. In Judith H Shulman (Ed.), *Case methods in teacher education* (pp. 50–63). Teachers College Press.

Mesny, A. (2013). Taking stock of the century-long utilization of the case method in management education. *Canadian Journal of Administrative Sciences*, *30*(1), 56–66. https://doi.org/10.1002/CJAS.1239

Moore, M. G. (1989). Three types of interaction. *The American Journal of Distance Education*, *3*(2), 1–6.

Morris, P. (2013). Reconstructing project management reprised: A knowledge perspective. *Project Management Journal*, *44*(5), 6–23. https://doi.org/10.1002/pmj.21369

Motowidlo, S. J., Dunnette, M. D., & Carter, G. W. (1990). An alternative selection procedure: The low fidelity simulation. *Journal of Applied Psychology*, *75*(6), 640–647. https://doi.org/10.1037/0021-9010.75.6.640

Nall, L. K. L. (2018). *Instructional designers as project managers: A phenomenology* (Document No. 13805600). [Doctoral Dissertation, Nova Southeastern University]. ProQuest.

Nendaz, M. R., Raetzo, M. A., Junod, A. F., & Vu, N. V. (2000). Teaching diagnostic skills: Clinical vignettes or chief complaints? *Advances in Health Sciences Education*, *5*(1), 3–10.

https://doi.org/10.1023/A:1009887330078

Olson, C. J. (2018). *Transitioning of instructional designers from preparatory programs to the workplace* (Document No. 13421508). [Doctoral Dissertation, Northern Arizona University]. ProQuest.

Olsson, N. O. E. (2006). Management of flexibility in projects. *International Journal of Project Management*, *24*(1), 66–74. https://doi.org/10.1016/j.ijproman.2005.06.010

Otway, H., & von Winterfeldt, D. (1992). Expert judgment in risk analysis and management. *Risk Analysis*, *12*(1), 83–93.

Perez, R. S., & Emery, C. D. (2008). Designer thinking: How novices and experts think about instructional design. *Performance Improvement Quarterly*, *8*(3), 80–95. http://www.jstor.org/stable/23370936

PMBOK (R) Guide and Standards. (2018). Project Management Institute. https://www.pmi.org/pmbok-guide-standards

Project Management Institute. (2004). *A guide to the project management body of knowledge (PMBOK (R) guide)* [Skillsoft] (3rd ed.). Project Management Institute, Inc. http://www.books24x7.com/marc.asp?bookid=9342

Project Management Institute. (2017). *A guide to project management body of knowledge (PMBOK(R) guide)* [Knovel] (6th ed.). Project Management Institute, Inc. https://app.knovel.com/hotlink/pdf/id:kt011DWZKA/guide-project-management/standard-project-management

Ramazani, J., & Jergeas, G. (2015). Project managers and the journey from good to great: The benefits of investment in project management training and education. *International Journal of Project Management*, *33*(1), 41–52. https://doi.org/10.1016/j.ijproman.2014.03.012

Reich, B. H., Gemino, A., & Sauer, C. (2012). Accidental project managers not a myth in the public sector. In *PM Perspectives*. PMPerspectives.org

Reiser, R. A. (2001). A history of instructional design and technology: Part I: A history of instructional media. *Educational Technology Research and Development*, *49*(1), 53–64. https://doi.org/10.1007/BF02504928

Richey, R. C., & Klein, J. D. (2007). *Design and development research*. Routledge.

Rolstada˚s, A. (2004). Time and Cost. In P. W. G. Morris & J. K. Pinto (Eds.), *Wiley Guide to Managing Projects* [Knovel] (pp. 781–804). John Wiley & Sons. https://app.knovel.com/hotlink/toc/id:kpWGMP0002/wiley-guide-managing/wiley-guide-managing

Romiszowski, A. (1991). Introduction to a special issue on case studies. *Performance Improvement Quarterly*, *4*(1), 3–4.

Roth, K. J., & Smith, C. (2009). Live case analysis: Pedagogical problems and prospects in management education. *American Journal of Business Education*, *2*(9), 59–66. https://doi.org/10.19030/ajbe.v2i9.4610

Rowland, G. (1992). What do instructional designers actually do? An initial investigation of expert practice. *Performance Improvement Quarterly*, *5*(2), 65–86.

Rowland, G., Fixl, A., & Yung, K. (1992). Educating the reflective designer. *Educational Technology*, *32*(12), 36–44.

Rowland, G., Parra, M. L., & Basnet, K. (1994). Educating instructional designers: Different methods for different outcomes. *Educational Technology*, *34*(6), 5–11.

Rumeser, D., & Emsley, M. (2019). Can serious games improve project management decision making under complexity? *Project Management Journal*, *50*(1), 23–39.

https://doi.org/10.1177/8756972818808982

Savelsbergh, C. M. J. H., Havermans, L. A., & Storm, P. (2016). Development paths of project managers: What and how do project managers learn from their experiences? *International Journal of Project Management*, *34*(4), 559–569. https://doi.org/10.1016/j.ijproman.2016.02.005

Schrag, P. G. (1989). The serpent strikes: Simulation in a large first-year course. *Journal of Legal Education*, *39*(4), 555–569. http://www.jstor.org/stable/42898101

Sharma, K. K., Israel, D., & Bhalla, B. (2019). Does previous work experience matter in students' learning in higher project management education? *Engineering, Construction and Architectural Management*. https://doi.org/10.1108/ECAM-01-2019-0015

Shelley, A. W. (2015). Project management and leadership education facilitated as projects. *International Journal of Managing Projects in Business*, *8*(3), 478–490. https://doi.org/10.1108/IJMPB-09-2014-0059

Shulman, L. S. (1992). Toward a pedagogy of cases. In J H Shulman (Ed.), *Case methods in teacher education* (pp. 1–30). Teachers College Press.

Slagter van Tryon, P. J., McDonald, J., & Hirumi, A. (2018). Preparing the next generation of instructional designers: a cross-institution faculty collaboration. *Journal of Computing in Higher Education*, *30*(1), 125–153. https://doi.org/10.1007/s12528-018-9167-3

Smith, P. L., & Ragan, T. J. (1999). *Instructional design* (2nd ed.). John Wiley & Sons.

Souid, L., & Koszalka, T. A. (2015). Training instructional designers: Engaging novices in ID process through a progressive case. *Proceedings for the Association for Educational Communications and Technology Convention*.

Souid, L., & Koszalka, T. A. (2018). Promoting cognitive flexibility using progressive cases:

Developing project management skills by introducing authentic and unexpected challenges. *Proceedings for EDULearn 2018 Convention*.

Spiro, R. J., Collins, B. P., & Ramchandran, A. R. (2007). Modes of openness and flexibility in cognitive flexibility hypertext learning environments. *Flexible Learning in an Information Society*, *June*, 18–25. https://doi.org/10.4018/978-1-59904-325-8.ch002

Spiro, R. J., Coulson, R. L., Feitovich, P. J., & Anderson, D. K. (1988). *Cognitive flexibility theory: Advanced knowledge acquistion in ill-structured domains*.

Spiro, R. J., Feltovich, P. J., & Coulson, R. L. (1992). Cognitive flexibility, constructivism, and hypertext: Random access instruction for advanced knowledge acquisition in ill-structured domains. *Constructivism and the Technology of Instruction*, *35*, 57–75. https://www.researchgate.net/publication/200772846

Spiro, R. J., Vispoel, W. P., Schmitz, J. G., Samarapungavan, A., & Boerger, A. E. (1987). Knowledge acquisition for application: Cognitive flexibility and transfer in complex content domains. In B. K. Britton & S. M. Glynn (Eds.), *Executive Control Processes* (pp. 177–199). Routledge.

Stacey, R. D. (1996). *Strategic management and organisational dynamics* (2nd ed.). Pitman.

Stake, R. E. (1995). *The Art of Case Study Research*. Sage Publications.

Stake, R. E., & Trumbull, D. J. (1982). Naturalistic Generalizations. In *Naturalistic Research Paradigms* (pp. 1–7). http://www.ed.uiuc.edu/circe/publications/naturalistic.pdf

Stepich, D. A., Ertmer, P. A., & Lane, M. M. (2001). Problem-solving in a case-based course: Strategies for facilitating coached expertise. *Educational Technology Research and Development*, *49*(3), 53–69. https://doi.org/10.1007/BF02504915

Sugar, W. A. (2014). Development and formative evaluation of multimedia case studies for

Instructional Design and Technology students. *TechTrends*, *58*(5), 37–53. https://doi.org/10.1007/s11528-014-0785-z

Sugar, W. A., & Luterbach, K. J. (2016). Using critical incidents of instructional design and multimedia production activities to investigate instructional designers' current practices and roles. *Educational Technology Research and Development*, *64*(2), 285–312. https://doi.org/10.1007/s11423-015-9414-5

Svejvig, P., & Andersen, P. (2015). Rethinking project management: A structured literature review with a critical look at the brave new world. *International Journal of Project Management*, *33*(2), 278–290. https://doi.org/10.1016/j.ijproman.2014.06.004

Sykes, G., & Bird, T. (1992). Teacher education and the case idea. *Review of Research in Education*, *18*, 457–521. http://www.jstor.org/stable/1167305

Szwed, P. S. (2016). *Expert judgment in project management: Narrowing the theory-practice gap* [Skillsoft]. Project Management Institute, Inc. https://syracuse.skillport.com/skillportfe/assetSummaryPage.action?assetid=RW$2858:_ss_book:115218#summary/BOOKS/RW$2858:_ss_book:115218

Tawfik, A. A., Alhoori, H., Keene, C. W., Bailey, C., & Hogan, M. (2017). Using a recommendation system to support problem solving and case-based reasoning retrieval. *Technology, Knowledge and Learning*, *23*(1), 1–11. https://doi.org/10.1007/s10758-017-9335-y

Tawfik, A. A., & Jonassen, D. H. (2013). The effects of successful versus failure-based cases on argumentation while solving decision-making problems. *Educational Technology Research and Development*, *61*(3), 385–406. https://doi.org/10.1007/s11423-013-9294-5

Theroux, J. M. (2009). Real time case method: Analysis of a second implementation. *Journal of*

Education for Business, *84*(6), 367–373. https://doi.org/10.3200/JOEB.84.6.367-373

Thomas, J., & Mengel, T. (2008). Preparing project managers to deal with complexity - Advanced project management education. *International Journal of Project Management*, *26*(3), 304–315. https://doi.org/10.1016/j.ijproman.2008.01.001

Thomas, J., Mengel, T., & Andres, N. (2004). Surfing on the edge of chaos--developing the master project manager. *Proceedings for PMI (R) Global Congress 2004--North America*. https://www.pmi.org/learning/library/complexity-theory-developing-master-project-manager-8281

Tracey, M. W., & Boling, E. (2014). Preparing instructional designers: Traditional and emerging perspectives. In J. M. Spector, M. D. Merrill, J. Elen, & M. J. Bishop (Eds.), *Handbook of Research on Educational Communications and Technology* (pp. 653–660). Springer. https://doi.org/10.1007/978-1-4614-3185-5_52

Tripp, S. D. (1994). How should instructional designers be educated? *Performance Improvement Quarterly*, *7*(3), 116–126.

Vanhoucke, M., Vereecke, A., & Gemmel, P. (2005). The project scheduling game (PSG): Simulating time/cost trade-offs in projects. *Project Management Journal*, *March*, 51–59. https://doi.org/10.1177/875697280503600106

Vogt, M. A., & Schaffner, B. H. (2016). Evaluating interactive technology for an evolving case study on learning and satisfaction of graduate nursing students. *Nurse Education in Practice*, *19*(July), 79–83. https://doi.org/10.1016/j.nepr.2016.05.006

Von Wangenheim, C. G., Savi, R., & Borgatto, A. F. (2012). DELIVER! - An educational game for teaching Earned Value Management in computing courses. *Information and Software Technology*, *54*(3), 286–298. https://doi.org/10.1016/j.infsof.2011.10.005

Wassermann, S. (1994). *Introduction to case method teaching: A guide to the galaxy*. Teachers College Press.

Weiss, J. W., & Wysocki, R. K. (1992). *5-Phase project management: A practical planning & implementation guide*. Perseus Books. http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:5-phase+project+management#1

Whitty, S. J., & Maylor, H. (2009). And then came complex project management (revised). *International Journal of Project Management*, *27*(3), 304–310. https://doi.org/10.1016/j.ijproman.2008.03.004

Willams van Rooij, S. (2011). Instructional design and project management: Complementary or divergent? *Educational Technology Research and Development*, *59*(1), 139–158. https://doi.org/10.1007/s11423-010-9176-z

Williams, S. M. (1992). Putting case-based instruction into context: Examples from legal and medical education. *Journal of the Learning Sciences*, *2*(4), 367–427. https://doi.org/10.1207/s15327809jls0204_2

Williams, T. C. (2011). *Rescue the problem project: A complete guide to identifying, preventing, and recovering from project failure* [Skillsoft]. AMACOM – Book Division of American Management Association. https://libezproxy.syr.edu/sso/skillport?context=38060

Williams van Rooij, S. (2009). Scaffolding project-based learning with the project management body of knowledge (PMBOK®). *Computers & Education*, *52*(1), 210–219. https://doi.org/10.1016/j.compedu.2008.07.012

Williams van Rooij, S. (2010). Project management in instructional design: ADDIE is not enough. *British Journal of Educational Technology*, *41*(5), 852–864.

https://doi.org/10.1111/j.1467-8535.2009.00982.x

Williams van Rooij, S. (2013). The career path to instructional design project management: An expert perspective from the US professional services sector. *International Journal of Training and Development*, *17*(1), 33–53. https://doi.org/10.1111/j.1468-2419.2012.00414.x

Winter, M., Smith, C., Morris, P., & Cicmil, S. (2006). Directions for future research in project management: The main findings of a UK government-funded research network. *International Journal of Project Management*, *24*(8), 638–649. https://doi.org/10.1016/j.ijproman.2006.08.009

Wood, M. (2011). The team is frustrated with rework based on changing requirements. In D. Garrett (Ed.), *Project pain reliever: A just-in-time handbook for anyone managing projects* (pp. 216–219). J. Ross Publishing.

Yanchar, S. C., & Gabbitas, B. W. (2011). Between eclecticism and orthodoxy in instructional design. *Educational Technology Research and Development*, *59*(3), 383–398. http://www.jstor.org/stable/41414947

Yin, R. K. (2018). *Case Study Research and Applications: Design and Methods* (6th ed.). Sage.

York, C. S., & Ertmer, P. A. (2011). Towards an understanding of instructional design heuristics: An exploratory Delphi study. *Educational Technology Research and Development*, *59*(6), 841–863. https://doi.org/10.1007/s11423-011-9209-2

Zhu, X., Yan, Y., & Sun, X. (2010). Dynamic case teaching and learning: Business education in web-based simulation environment. *ICCSE 2010 - 5th International Conference on Computer Science and Education, Final Program and Book of Abstracts*, 667–670. https://doi.org/10.1109/ICCSE.2010.5593523

Zwikael, O., & Gonen, A. (2007). Project execution game (PEG): Training towards managing unexpected events. *Journal of European Industrial Training*, *31*(6), 495–512. https://doi.org/10.1108/03090590710772668

Vita

LINA SOUID

EDUCATION

PhD in Instructional Design, Development, and Evaluation 2020
Syracuse University, Syracuse, NY

MS in Instructional Technology 2014
Syracuse University, Syracuse, NY

MA in Teaching: Secondary Mathematics 2011
Western Governors University, Salt Lake City, UT

BS in Bio-engineering, BA in Psychology 2007
Syracuse University, Syracuse, NY

EMPLOYMENT (Selected)

Learning and Development Supervisor 2020-Present
Jack Henry and Associates, Dallas, TX

Senior Learning and Development Specialist 2019-2020
Jack Henry and Associates, Dallas, TX

Learning and Development Specialist 2018-2019
University of Denver, Denver, CO

Assistant Director of Programs 2015- 2018
University of Denver, Denver, CO

Interim Program Director, Instructor, Coordinator 2011- 2013
Syracuse University: Say Yes to Education, Syracuse, NY

LEARNING AND DEVELOPMENT PROJECTS (Selected)

Faculty Training in ID: Instructional Design Consortium, *Syracuse University*, 2014-2015
Self-Directed Online Capstone: Research Apprenticeship, *Syracuse University*, 2012-2015

TEACHING EXPERIENCE (Selected)

Online and Classroom Facilitator, Various topics, *Jack Henry and Associates*, 2019-Present
Teaching Assistant, Instructional Design and Development I, *Syracuse University*, 2014
Teaching Assistant, Computers as Critical Thinking Tools, *Syracuse University*, 2014

AWARDS (Selected)

Syracuse University Graduate Fellowship Award*:* 2013-2016
AECT Design and Development Showcase: 2014

PEER-REVIEWED PUBLICATIONS

Hall, J.A., Koszalka, T.A., **Souid, L**., & Wu, Y. (2014). Designing Feedback to Increase Interaction and Learning in an Online Self-Study Course. *Proceedings for the Association for Educational Communications and Technology Convention*. Jacksonville, FL.

Souid, L. & Koszalka, T.A. (2015). Motivating design elements: Supporting learners in a self-directed online capstone. *Proceedings for the Distance Teaching and Learning Conference*. Madison, WI.

Souid, L. & Koszalka, T.A. (2015). Training Instructional Designers: Engaging Novices in ID Process through a Progressive Case. *Proceedings for the Association for Educational Communications and Technology Convention.* Indianapolis, IN.

Souid, L., Koszalka, T. A., Wu, Y., & Hall, J. A. (2014). Collaborative design of an online self-directed course: An example of a cognitive apprenticeship. *Proceedings for the Association for Educational Communications and Technology Convention.* Jacksonville, FL.

Souid, L., Wu, Y., Hall, J. A., & Koszalka, T. A. (2014). Computers as critical thinking tools: Primarily self-directed, online capstone course. *Proceedings for the Association for Educational Communications and Technology Convention*. Jacksonville, FL.

Souid, L., Koszalka, T.A. (2018). Promoting Cognitive Flexibility using Progressive Cases: Developing Project Management Skills by Introducing Authentic and Unexpected Challenges. *Proceedings for EDULearn 2018 Convention.* Spain.

Wu, Y., Koszalka, T. A., **Souid, L.**, & Hall, J. A. (2014). Course design features that can reduce academic procrastination in self-directed online courses. *Proceedings for the Association for Educational Communications and Technology Convention*. Jacksonville, FL.

PEER-REVIEWED CONFERENCE PRESENTATIONS

Hall, J.A., Koszalka, T.A., **Souid, L.**, & Wu, Y. (2014, November). Designing Feedback to Increase Interaction and Learning in an Online Self-Study Course. Paper presented at annual meeting of the Association for Educational Communications and Technology Convention. Jacksonville, FL.

Souid, L., Koszalka, T.A. (2016, October). Developing a Community of Inquiry in a Condensed Online Course: Identifying Effective Instructional Methods. Paper presented at annual meeting of the Association for Educational Communications and Technology Convention. Las Vegas, NV.

Souid, L. (2014, April). Considerations when Choosing Inquiry Methods: Recommendations from Theory. Paper presented at the annual meeting of the Eastern Evaluation Research Society. Galloway, NJ.

Souid, L. (2015, April). Supporting Self-regulation, Self-efficacy, and Competence in a Self-Directed Online Capstone Course: A Design-based Research Approach. Paper presented at annual meeting of the American Educational Research Association. Chicago, IL.

Souid, L. & Koszalka, T.A. (2015, August). Motivating design elements: Supporting learners in a self-directed online capstone. Paper presented at annual meeting of the Distance Teaching and Learning Conference. Madison, WI.

Souid, L. & Koszalka, T.A. (2015, November). Training Instructional Designers: Engaging Novices in ID Process through a Progressive Case. Paper presented at annual meeting of the Association for Educational Communications and Technology Convention. Indianapolis, IN.

Souid, L., Koszalka, T. A., Wu, Y., & Hall, J. A. (2014, November). Collaborative design of an online self-directed course: An example of a cognitive apprenticeship. Paper presented at annual

meeting of the Association for Educational Communications and Technology Convention. Jacksonville, FL.

Souid, L., Wu, Y., Hall, J. A., & Koszalka, T. A. (2014, November). Computers as critical thinking tools: Primarily self-directed, online capstone course. Paper presented at annual meeting of the Association for Educational Communications and Technology Convention. Jacksonville, FL.

Souid, L., Koszalka, T.A. (2018). Promoting Cognitive Flexibility using Progressive Cases: Developing Project Management Skills by Introducing Authentic and Unexpected Challenges. Paper presented at annual meeting of the EDULearn 2018 Convention. Spain.

Wu, Y., Koszalka, T. A., **Souid, L.**, & Hall, J. A. (2014, November). Course design features that can reduce academic procrastination in self-directed online courses. Paper presented at annual meeting of the Association for Educational Communications and Technology Convention. Jacksonville, FL.