Mentoring strategies in a project-based learning environment: A focus on self-regulation

by

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Abstract

The main purpose of this Action Research investigation was to better understand how post-secondary faculty mentor self-regulatory behaviours in a project-based learning environment (PjBL). The secondary purpose was to understand how the Action Research process supported faculty in their mentoring. Lastly, understanding learner perceptions of being mentored and how the faculty's mentoring of specific self-regulatory behaviors would align with the expectations of the video game industry, would provide a cross-section of intrigue into the investigation. The research context was the Master of Digital Media Program in Vancouver, Canada. The MDM Program specializes in providing learners, organized in project teams, the opportunity to work on real-world digital media projects. Three faculty mentors and three student teams participated in this study; each team was tasked with co-constructing video-game prototypes for three game companies over a four-month period. Pre-research interviews with established members of the video game industry in Vancouver were conducted in order to determine what qualities and skills they looked for when hiring new recruits. Data from these interviews revealed characteristics of self-regulation, such as self-motivation, 'ownership', the ability for recruits to manage their own learning, and self-reliance as being of primary importance. A pilot study was then undertaken to operationalize self-regulation as reflected in the mentoring practices of one MDM faculty member and assess the effectiveness of the planned data collection procedures. The primary investigation consisted of video recording the mentoring sessions of three faculty and three student teams, a total of 18 students. Video recorded mentoring sessions were observed and discussed by the researcher and each faculty member in a one-on-one interview setting. Final faculty and student interviews were conducted. Data from pre-research interviews, the stimulated recall sessions, and final interviews were analyzed and triangulated. Triangulation of learner interviews revealed that mentors supported self-regulatory behaviors using a variety of strategies, which are described in detail. Triangulation of pre-research interviews revealed that mentors were supporting learners in their development of specific characteristics expected of new recruits transitioning into the video game industry.

Keywords: project-based learning; mentoring, self-regulation, strategies, client, action research

Dedication

Dedicated to my wife Sheinagh Anderson, my ongoing collaborator and mentor.

Acknowledgements

I am indebted to the support and patience of my supervisor Dr. Cheryl Amundsen throughout my PhD experience. Her ongoing challenge for me to explain myself and my ideas more fully and simply have contributed to the development of my scholarly voice. Thanks as well to Dr. Kevin O'Neill whose humorous comments and suggestions riddled throughout my dissertation have made my writing stronger. I also acknowledge the support and critical challenges offered by members of my ETLD cohort, particularly Lynda Beveridge and our caffeinated discourse. I owe gratitude and respect to all the MDM faculty mentors who participated in the investigation and whose inventive mentoring strategies inspired me to improve my own. I thank the learners at the MDM program who challenged me to become a better teacher, researcher and mentor. I also appreciate the support of the director of the Master of Digital Media Program, Dr. Richard Smith who encouraged my endeavors to complete this doctoral degree. Thanks as well to Jeannette Kopak for providing advice and perspective. Special thanks to Jon Festinger for engaging in scholarly discussions over food, text, phone, conference, streaming technologies … any time actually and for being supportive of my scholastic aspirations. Thank-you to my colleague Larry 'drop-the-mic' Bafia for animated debates, discourse over jazz and red wine and who I will always regard as the mentor's mentor. Thanks to my family who have endured my intellectual rants and pedantic lectures. Finally, I would also like to acknowledge the love and support of my dearest Sheinagh Anderson who listened to my most boring of drony tones, and in doing so, helped me to improve the articulation of all my ideas.

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List of Acronyms

AR	Action Research
BC	British Columbia
BCIT	British Columbia Institute of Technology
EA	Electronic Arts
ECUAD	Emily Carr University of Art and Design
ETLD	Educational Technology and Learning Design
GDD	Game Design Document
GNWC	Great Northern Way Campus
MDM	Master of Digital Media
OARRs	Objectives, Agenda, Rules and Roles
PBL	Problem-based learning
PjBL	Project-based learning
SFU	Simon Fraser University
SR	Self-regulation
UBC	University of British Columbia

Glossary

Agile	A project management methodology persistently adapted at the MDM Program that features a method of shortening longer production cycles into ‘sprints’ in which specific features of a digital media prototype are created. Prototypes demonstrate a working aspect of the digital media artifact at various levels of fidelity (detail, material and functionality). Agile production environments rely on team members to be self-sufficient, communicative, transparent and to manage their time productively.
MDM Program	The Master of Digital Media Program is a distinctive professional graduate program in digital media that began in 2007. It is jointly operated and accredited by four University partners in the Lower Mainland of Vancouver, BC. These are SFU, UBC, ECUAD, and BCIT. Currently, the program is administered by Simon Fraser University. The MDM Program is located on Great Northern Way Campus (GNWC), an 18-acre site on False Creek donated by Finning to all four University partners in 2001. The initial goal of the program was to create an advanced professional degree that would support and accelerate its graduate’s transition as central participants into various digital media communities of practice.
Mentoring	Mentoring defines the primary activities of all faculty at the MDM Program and is a term that requires a definition in context. At the MDM Program mentoring encompasses activities of guidance, teaching, supervision, advising, coaching and preparing learners for transitioning into various digital media communities of practice.
PjBL	Refers to project-based learning and differentiates itself from PBL (problem-based learning). In the theoretical and research literature PjBL is represented as either subsumed by PBL, independent of it or part of a larger category of Inquiry Learning.

Self-regulation	Self-regulation refers to the idea of learners managing their own learning. Self-regulating learners display characteristics such as ownership of the learning, self-management, problem-solving, self-initiative, goal-setting, self-reliance, self-motivation and more. In the literature, self-regulation has been identified as a key learning outcome of PjBL environments. At the MDM Program learners are challenged to learn how to manage new processes, methodologies, collaborative interactions and client relationships.

Preface

This dissertation represents the culmination of my PhD in Educational Technology and Learning Design at Simon Fraser University. The focus over the course of my studies was directed at deepening my understanding of the design, research and teaching challenges inherent in project-based learning environments. Completing my course of studies at this time has contributed to the ongoing advancement of the MDM Program's PjBL environment.

Chapter 1. Introduction

The purpose of this research was to document an Action Research investigation of the mentoring practices of faculty in the Master of Digital Media (MDM) Program. In this introductory chapter, I provide a rich description of the MDM Program to help the reader understand the context, motivation and purpose for conducting this research. Since the projects that students and faculty engaged with involved the co-construction of a video game, I begin with a description of the video game industry in Vancouver. The second part of this chapter describes my motivation and purpose to conduct Action Research and the primary and secondary research questions. The third section provides a brief overview of how the research process was structured and how the rest of the thesis is organized.

1.1. Vancouver: An international hub for the video game industry

In March of 2016, the Entertainment Software Association of Canada (ESAC) reported that "Canada's video game industry projects 1,400 jobs at the intermediate and senior levels will be created in the next 12 to 24 months" (http://theesa.ca/2016/03/03/press-release-skills-training/).

Currently, Canada's video game industry employs over 20,000 workers and contributes $3 billion to Canada's GDP yearly (ESAC, 2016). The city of Vancouver itself has, over several decades, established itself as "one of the oldest video game clusters in North America" (ESAC, March 11th 2016). At the end of 2013 there were 67 video game companies in British Columbia, but a 2015 poll revealed a substantial increase to 128 companies; the majority (63%) of which are considered standard-sized companies of 5-99

employees (http://theesa.ca/2016/03/03/press-release-skills-training/).

The establishment of a project-based learning (PjBL) curriculum at the MDM Program was informed by pioneers in the digital media industry (including the video game industry). They expressed the global need for future industry employees to have more hands-on experience co-constructing digital media products, in as-close-to real world scenarios as possible. It was thought that in addition to skill acquisition, such an approach would also provide learners the necessary collaborative skills to become part of what is essentially, a team-based digital media industry. Some of the initial financial support for the MDM Program came from the video game industry in the Lower Mainland of Vancouver, including Electronic Arts, the program's biggest sponsor. EA is one of the first, largest and most enduring video game companies in the Lower Mainland. Because of this early influence and the persistent presence of the video game industry in the province of British Columbia (BC), 20% of the MDM Program's project clients have been video game companies and over 40% of learners have transitioned into the video game industry. Game companies continue to approach our program as clients for prototype game development, tasking teams of learners to co-construct iterative phases of a digital game artifact that can demonstrate a level of a game, a game concept, a game mechanic, etc. In essence learners at the MDM Program assigned to video game projects, co-construct digital artifacts that, while incomplete, can be further developed when submitted to a client. As Dennis Chenard, Director of Industry Relations at the MDM Program, often asserts, "our teams act as the R&D that many companies don't have the resources to manage" (D. Chenard, personal communication, December 5th, 2015).

1.2. Rich description of the Master of Digital Media Program

The Master of Digital Media Program was created in 2007 "in response to a request from, and with support of, the regional government" (Smith & Pennefather, 2014, p. 151) of British Columbia, and is described as a professional graduate degree. The

program is a “joint venture of - and operates at arm’s length from - four institutions of higher learning” (Smith & Pennefather, 2014, p. 152): University of British Columbia, Simon Fraser University, Emily Carr University of Art + Design and British Columbia Institute of Technology.

While the curriculum was initially modeled “on a similar program at Carnegie Mellon University (CMU), called the Entertainment Technology Centre (ETC)” (p. 153), its focus has become much broader than creating “leaders for the game industry” (p. 153). For example, learners may co-construct interactive digital experiences for web and mobile applications as well as for wearable technologies. They may engage in building physical/digital hybrid installations in museums in Canada and China. The MDM Program also welcomes partnerships with University researchers and government agencies. Finally, the program has a strong track record of creating products and solutions for the health care industry. The diversification of the curriculum has been a direct result of responding to the changing demands of the local digital media industry in Vancouver, where approximately 50% of our graduates are hired after graduation.

The MDM Program consists of three semesters of study with an internship semester at the end. While learners enroll in more typical 3-credit courses in their first semester, the majority of their activities in their second and third semesters consist of 12-credit project-based courses. The goal of each project-based course is to deliver a tangible digital media artifact within a 13-week production cycle. Projects are generally proposed by game companies, mobile application developers, web developers, and university researchers. Some examples of applications include: entertainment, health, education, and knowledge dissemination for science. One differentiating feature from other institutions is that each project is proposed by a real-world company, organization or institution.

1.2.1. First semester core courses

In their first semester, learners are exposed to four core courses with inter-connected learning outcomes. These courses are meant to support the management of

team-developed ideas, the co-construction of digital media artifacts in subsequent semesters, and the management of clients in the second and third semester projects. Within the course entitled Interdisciplinary Improvisation, learners are exposed to a wide variety of tools that aim to support the adaptive, creative and collaborative challenges inherent within many standard-sized digital media companies. The improvisation course relies predominantly on kinesthetic exercises, guided self-reflection and readings that target specific characteristics of improvisation that relate to team-based collaboration. The Projects 1 course provides learners the opportunity to develop smaller scale and shorter term digital media projects within small teams of 5-7 over the course of the semester. This course affords them hands-on experience developing their ideas together, solving design problems, co-constructing user-centric prototypes leading to increasingly developed digital artifacts, and managing their project and one another. The Foundations of Digital Media course introduces students to the industry context (e.g., intellectual property law), and the technical fundamentals and historical precedents, dynamics (e.g., artistic impetus and business processes), and impacts (e.g., social and cultural effects) of interactive and online media products.

Finally, the Game Design course prepares learners to design interactive play from a user-centric perspective. Learners examine how potential users interact with "various aspects of games – from 'indie' to 'triple A' titles, including mechanics, emotion, agency, balance, motivation and the process of making games (plan, build, test and repeat!)" (According to Fracchia, 2015, p. 1). Importantly, this course integrates the theory and practice of game design, teaching learners' principles of interactivity within game environments, and how to apply these to the development of any interactive application or experience.

Since its inception in 2007, 20% of the projects at the MDM Program have come from clients in the video game industry. Game clients have included Electronic Arts, Ubisoft, Bandai Namco, Microsoft Studios, Work [at] Play, Roadhouse Interactive, Skybox Labs, Kabam, and other standard-sized companies. Many projects have also

involved serious games or some aspect of gamification with a variety of companies from the digital media industry, non-profit organizations and government agencies such as Arthritis Research Centre of Canada and the U.S. Department of Energy. The most common programming environment to emerge in the last four years for game development projects has been Unity 3D.

1.2.2. Second semester project courses: Learner and faculty mentor activities

Prior to the beginning of the second semester, faculty mentors along with the Director and Associate Director of the MDM Program match learners to a project. While learners do not have a choice which project they will be assigned to, care is taken in matching learners with their communicated interests, career goals and skills. A range of varied skillsets are required on each project. Recent project types (2016) include mobile video games, e-health, mobile applications, museum installations, virtual reality games, wearable technologies and 3D architectural visualization. A typical project-based course consists of a team of five to seven learners assigned to solve a real world problem for a client through a 13-week process.

Orientation: Weeks 1 and 2

On their first day of the PjBL course, learners are assigned to a team and meet with their faculty mentors in pre-assigned project rooms where they will work for the next 13 weeks, roughly four days a week, usually for 8-hour days. Teams are given a brief overview of the project including a description of the client and the problem or challenge they will be tasked to solve. The team prepares for their first meeting with the client, usually scheduled on the second or third day of the first week. Learners are also directed to read the project course outline. Faculty mentors encourage learners to create personal learning goals. They also go over their expectations of learners, define their availability for the team and one-on-one meetings, and define how they will interact with the team over the course of the semester.

Learners tend to decide upon their own roles by the end of the first or second week in consultation with the faculty mentor. Faculty mentors ensure that the team has considered all the necessary roles that are required in order to co-construct a digital media artifact that effectively solves the client's design problem. Roles on game projects typically include a project manager, programmer(s), 2D and/or 3D artist, a game designer and a user-interface designer who often takes on the additional role of a user experience designer. Often, learners take on multiple roles depending on the needs of the project and the size of the team.

Faculty mentors challenge learners to apply design tools that they learned in first semester courses and re-contextualize their use in situ. The design tools support learners in identifying and proposing solutions to user-centered design problems. Some support the development, prioritization and management of their ideas together. Other tools support learners in managing their interactions with one another and their client. Still others, support learners to scope all the features of the digital media artifact that they will co-construct over the course of 13 weeks. Some of the tools, such as OARRs to manage the client, Rules of Play to manage team behaviors and Persona to support the user-centered design process are defined in Appendix B. To help them manage all their ideas and the process of co-constructing the digital media artifact itself, principles of Agile project management are taught including the use of User Stories, Sprints and Scrum (see Appendix A).

After an initial 'meet-and-greet' with their clients, teams set up protocols to communicate and manage their relationship with them. Faculty mentors guide a team of learners to focus their energies on developing one or more ideas that are pitched to the client by the middle to end of the second week of the semester. Pitches include a proposition that aims to solve a particular problem or challenge that the client has more clearly defined in-person. Pitches are not always successful on their first presentation.

Faculty mentors work with learners to refine pitches iteratively and learners must negotiate with their clients in order to move forward to the next phase of the project.

Pre-production: Weeks 3 and 4

After successfully pitching a project idea that aligns with the interests of the client, learners move the state of the project forward by creating a series of physical and virtual prototypes. Prototypes consist of one or more features that represent a part of the full interactive product/experience that they will co-construct. They are early and rough models or representations of a product that don't always represent the entire interactive experience. In the MDM Program prototypes have manifested in a variety of forms. These include, low fidelity rough sketches on paper, physical prototypes made from cardboard, popsicle sticks, paper and glue, and higher fidelity art, environment and game mechanics in a programming environment like the Unity 3D game engine. Often, learners rapidly prototype how a user might interact with elements of an application's user interface using third party software like POP, Axxure and others. Often the term 'grey-boxing' is used by learners to refer to the use of simple 3D objects that represent unfinished art assets used in a programming environment to validate a game mechanic. For example, grey-boxed objects are typically created or imported into Unity 3D to demonstrate how a character might jump to avoid being hit by a moving object.

Part of the reason learners create prototypes is to ensure that they are on the right track towards solving the client's design problem before developing features at increasing levels of fidelity. The level of fidelity runs on a continuum from low to high referring in part to the amount of detail and functionality in a prototype. Clients may not be able to fully respond to the ideas that learners are proposing until they see the idea manifest as a low to medium fidelity prototype. Similarly, once learners see their prototypes in action they can affirm or challenge some assumptions that were made about the design, aesthetic or idea.

The design, functionality, art-style, and interaction present in prototypes are informed by principles of user-centered design that faculty mentors challenge learners to persistently keep 'top of mind'. In other words, prototypes are always constructed with potential users in mind. Tools that the team of students learn in their first semester inform and define the overall user experience of the game prototype they will co-construct. These include a variety of visual maps and processes that help the team and client align who the prototype is for, and how a potential user will interact with it. Psychographic visual maps like Personas task learners with visually representing a potential user of their product and the type of characteristics associated with that target group. A Day in the Life map is a visual storyboard of all the potential interaction points a potential user might have with the product during the course of a day. Each of these maps is described with a visual example in Appendix B.

Production: Weeks 4 or 5 to 10

Once the team of learners, client and faculty mentor are aligned on what will be produced, the team attempts to pre-plan what they can co-construct with the remaining time that they have. Here, they build upon existing low to medium fidelity prototypes and develop features at increasing levels of fidelity that contribute to what the final interactive artifact will be. As detailed in Appendix A, the duration of time in which the learners will construct features that contribute to their next 'working' prototype is referred to as a 'sprint'. Teams usually divide up the rest of the time that they have for their projects into a number of short one to two week sprints. Sprints help the team organize itself, manage time and adapt to unexpected changes to the design that impact the prototypes that they will deliver. Each day of a sprint, learners update each other in a Scrum. Scrums are short meetings where each team member states what they worked on the previous day, what they will work on that day, and what they need from other team members in order to complete tasks assigned to them or remove impediments that may be preventing them from moving forward with their assigned tasks.

Throughout all phases of production faculty mentors provide feedback, guidance, supervision, and management sometimes on a daily basis, while empowering learners to take ownership of the design process. At the culmination of each sprint, learners along with their faculty mentor meet with their client in order to present ideas, prototypes, and project updates. Client meetings are scheduled on a weekly basis, although by mid-semester, as projects progress, they tend to occur every two weeks. Following client meetings, teams conduct retrospectives with their faculty mentors in order to discuss their progress and plan their next sprint. At these intercession points faculty mentors provide guidance based on how learners manage the client, the project and one another.

One-on-one meetings with individual members of the team occur as needed throughout the semester. Two formal peer-review sessions are integrated into the design of a project course. One occurs in the middle of the semester and the other at the end of the semester. Peer-review sessions provide learners an opportunity to review their work, and discuss the strengths and weaknesses of the project and one another with mentor facilitation.

Weeks 11 to 13

The last few weeks of the project course are the most intense. Learners need to balance their time between completing their projects, completing the documentation of the project, as well as finishing the required assignments for an elective course they also take during the semester. During this time, learners strive to complete all the features of the final product and ‘hand it off’ to the client, including extensive documentation.

The language to describe the final ‘deliverable’ that learners submit (along with documentation) varies. Some examples include a ‘proof of concept’ (proving out the initial gameplay ideas), a ‘vertical slice’ of the game (a working level of the game, for example) or a ‘beta build’ (working prototype that affords limited gameplay but which gives the player a sense of how to win or lose the game).

Documentation

As noted, documentation for each project is extensive (75 to 150 pages). A game design document (GDD) usually includes a statement of the problem that the digital media product solved. For example, developing a game on new hardware, exploring a different type of game that the sponsor company has not yet attempted to bring to market, or creating a game prototype for a client to pitch to a specific investor. In addition, each GDD consists of an executive summary of the project, the problem the project solved, how the project was managed, team composition and roles, a detailed articulation of every aspect of the game's design, and the rationale that supported the design decisions that the team made. Examples of art assets are included and discussed. A description of the programming environment and examples of code are also included. An additional technical document is integrated that provides examples of the code that was used, how problems were overcome and delineates why a particular coding path was chosen.

During the summer semester learners repeat the process with a new project and a new team (Projects 3 course). The research reported here was conducted in the context of three Projects 2 courses.

Summary of what learners need to manage in a projects course

Figure 1 shows the three areas that learners must be able to manage in order to deliver a working digital prototype for a client in a typical 2nd semester project course.

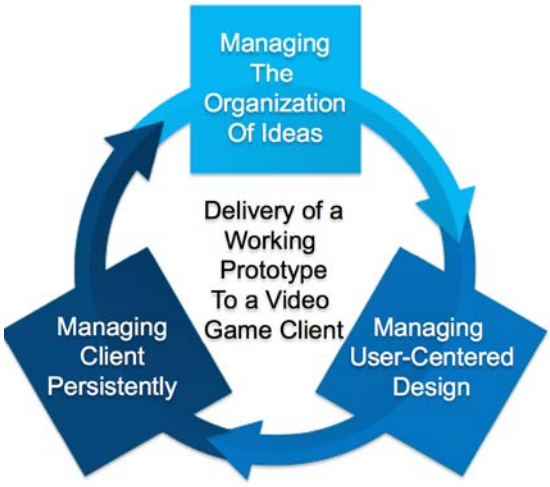

Figure 1: Learner management of a working prototype for real client.

Since the focus of this research was MDM faculty mentoring of learners on projects, Figure 2 presents the MDM institutional perspective of mentoring what learners need to manage in their project course.

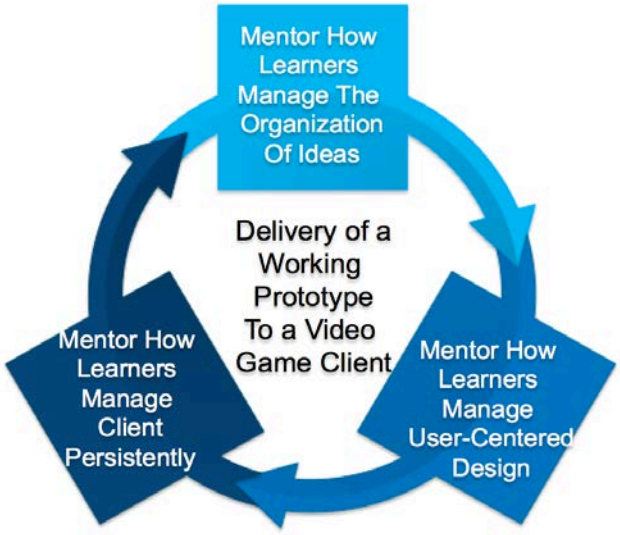

Figure 2: What faculty mentors facilitate the management of.

1.3. The Digital Industry Client

As mentioned above, one aspect that makes the MDM Program distinctive is that real-world industry clients commit to work with a student team for a period of 13 weeks. The challenge with this arrangement comes down to how hands-on or hands-off clients can be and how much time each client can devote to the team of learners. Each client is unique in the approach they take in collaborating with learners. Some are more committed to teaching learners directly. Others prefer to manage the learners as a contractor-client relationship. Still others are engaged in quite a limited way, leaving the team of learners a high degree of independence in developing their initial ideas into tangible and working prototypes.

Learners are tasked to develop a project charter. This is a document that serves as a written agreement of what the team will deliver to the client. In this agreement, the team of learners agrees to "deliver a digital media solution based on a defined problem, the project plan and schedule worked out between the sponsor and the team" (MDM Client Agreement, p. 1).

The MDM Program team emphasizes that project courses are primarily a learning experience, considering that they occur within the academic context of SFU and other partner institutions. This is an important factor to communicate to clients prior to their engagement with student teams. While the faculty interactions with learners form the majority of the mentoring that transpires, learners can also be exposed to mentoring from the client. The ideal situation is for clients to be comfortable with learners solving design problems with them. One of the faculty mentor's goals is to mentor learners into earning the trust of the client early on.

1.4. MDM Faculty

The faculty members who mentor teams of learners tend to come from a variety

of professional backgrounds in the digital media industry. All have maintained a connection to their various communities of practice and some continue to work within them as either consultants, mentors or in part-time work-for-hire scenarios. They are hired by the MDM program specifically for their professional backgrounds in related disciplines and for their experience managing real-world projects. They rely on their own expertise "to inform their facilitation of a project" (Smith & Pennefather, 2014, p. 154) and apply this expertise to the many different kinds of digital media projects they mentor. The bulk of their applied research activities include maintaining the current practices of project development that are aligned with their respective communities of practice, supporting learners to integrate and document user-centric design methodologies (user experience and user testing for example), and the supervision of extensive documentation of each project as a type of case study.

Conducting research within the MDM Program's PjBL environment was always of greatest concern throughout my PhD coursework in SFU's PhD program in Educational Technology and Learning Design. As a faculty member in the MDM program myself, my objective has been to understand and reflect upon my own teaching practice. One of the challenges we have had as a young program (2007), with a mixture of full time and part time teaching faculty, is the lack of research into our own practice. Prior to this research, the mentoring practices employed by each faculty member were mostly unknown. The most we knew of our processes was that each faculty member drew from their own experience as an industry professional in order to offer mentorship to learners and groups of learners. Since every project is uniquely situated and each team composed of different groups of learners, challenges arise that require different mentoring strategies to address the collaborative and creative challenges that may spontaneously emerge. How each faculty mentored learners, prior to this research, was only revealed in short informal reports and/or condensed accounts of learner interactions at weekly faculty meetings. The collective notions of those interactions have been generally referred to as guidance, management, advising, supervision, coaching and mentorship.

1.5. Relying on previous research in PjBL environments

There is little published research focusing on project-based learning at the post-secondary or graduate level. There is even less research into the interactions that regularly occur between learners and faculty mentors. While there exists research that investigates guidance, mentorship and coaching in constructivist environments, there is scant evidence of how mentoring is expressed within adult-oriented project-based learning environments. By focusing on the interactions between faculty mentors and learners, my intention was to better understand what was being mentored. I also wanted to ascertain what behaviors the video game industry was looking for in new recruits and consider this in the context of how faculty worked with students.

The pre-research interviews I conducted with members of the game industry in Vancouver made me even more sure I was on the right track with this agenda. Informal discussions with members of the video game industry as to what they are looking for in new recruits have always been the norm for MDM Program faculty, yet these discussions have never been formalized to any degree. Therefore, I decided to conduct interviews with video game industry members who had also been clients of and/or had taught within the MDM Program. I felt these individuals would be keenly aware of how the MDM Program operated, even though the bulk of their professional activities involved being active leaders of their own video game companies. Their roles included working in leadership positions in standard (5-99 employees) and large (over 99 employees) video game companies (Electronic Arts, Radical Entertainment, Roadhouse Interactive, Pugfarm Studios and Silicon Sisters). All four of the professionals I interviewed had experience managing their own standard-sized game studios, and a well-honed practice of hiring and mentoring hundreds of new recruits. All had witnessed some of the recruits they had hired transition into key roles in their own companies, or other game companies in Vancouver.

Important attributes for new recruits emerged from these interviews, such as ongoing learning, self-management, concepts of ownership of tasks and problems, ability

to take risks, fail, adapt and learn from mistakes. While the interviewees did not specifically use the term “self-regulation”, a term commonly used in the scholarly literature, key themes they identified were consistent with the notion of self-regulation. For example, interviewees identified the importance of new recruits managing their own learning and continuing to develop their problem-solving skills. This made me question what strategies MDM faculty were using when mentoring learners.

Research Purpose

The pre-research interviews with members of the game industry helped refine my research purpose: to investigate the mentoring strategies that faculty mentors employ on video game project courses at the MDM Program in order to support learner self-regulatory behavior.

1.6. Research Questions

1.6.1. Primary Question

How do faculty at the Master of Digital Media Program mentor learners on real-world projects?

1.6.2. Secondary Research Questions

- In what ways did faculty participants report that the Action Research Process supported their mentoring practice?
- What were learner perceptions of the faculty's interactions with their teams?
- How did the faculty's mentoring of specific self-regulatory behaviors align with the expectations of the video game industry?

1.7. Research Structure

Overall, my research was structured in three phases as depicted in Figure 3.

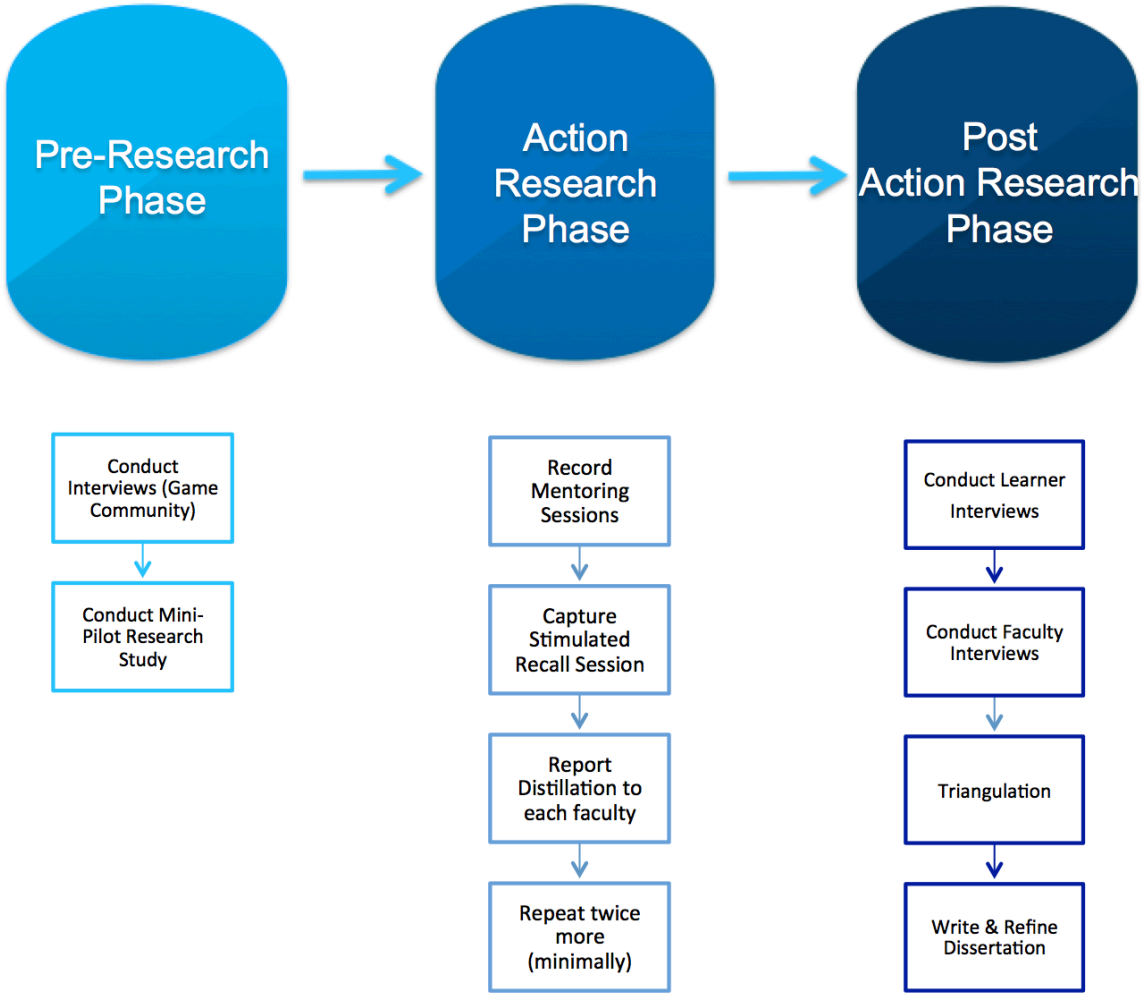

Figure 3: Three phases of research.

1.8. Thesis Structure

This PhD dissertation documents the three phases of research highlighted above. I will provide readers with a theoretical and epistemological positioning of my research within the project-based learning field in Chapter 2. To situate my research, I will then provide a comprehensive literature review of PjBL and its intersections within research conducted on mentoring self-regulation using an Action Research (AR) methodology (Chapter 3). In Chapter 4, I discuss why Action Research was a good fit for this study. In Chapter 5, I describe how the data were organized and analyzed and triangulated.

Interspersed with this, I discuss the research findings. In Chapter 6, I will present warranted assertions (Dewey, 1941) based on a triangulation of pre-research data with primary research data, present the limitations of the study, and directions for further research.

Chapter 2. Philosophical and Theoretical Positioning

Researchers of PjBL environments do not all draw from the same theories and philosophies, so it is important for me to define my own positioning within the field. In this chapter I will first detail my ontological and epistemological positioning, and discuss how it relates to both positivist and interpretivist PjBL research. Drawing from the theoretical literature that describes how people learn in PjBL environments, I will then align my positioning with Cook and Brown's (1999) model of knowledge and knowing in individual and group learning. Many of the theoretical assertions drawn from PjBL research have emerged from investigations whose central phenomena have investigated only the individual learner. To support my investigation of faculty mentoring, I will propose a theoretical stance that relies on Action Research as a methodology that supports practitioner research through reflection on practice. Finally, I will attempt to reframe generalizations drawn from PjBL research to support any knowledge claims that come out of my investigation. I will do so drawing from Dewey's (1941) notion of warranted assertions and Stake's (1983) concept of naturalistic generalizations.

2.1. Ontological and epistemological positioning

While some scholars and researchers (Creswell, 2007, 2013, 2014; Grix, 2010, Mack, 2010) would agree that "research paradigms are based on certain ontological and epistemological assumptions" (Asif, 2014, p. 14), these assumptions are not always made obvious nor transparent in published work. For Grix (2010), the "choice of methods will be influenced by ontological and epistemological assumptions and, of course, the questions you are asking, and the type of project you are undertaking" (p. 30). This is why positioning my own PjBL research necessitates first breaking down my own ontological assumptions, which, according to Blaikie (2007) implicates those "assumptions that are made about the nature of social reality, claims about what exists, what it looks like, and what units make it up and how these units interact with each other"

(p. 8). Drawing upon specific scholars like Blaikie who assert that “ontological assumptions are concerned with what we believe constitutes social reality” (p. 8), informs my own belief of the social nature of project-based learning at the MDM Program. My own ontological orientation towards PjBL research at the MDM Program is anti-foundationalist. That is, my ontology aligns with the view that “reality is socially and discursively constructed by human actors” (Grix, 2010, p. 61) as opposed to the foundationalist view that “reality is thought to exist independently of our knowledge of it” (p. 61).

2.2. Positivist research in PjBL

Much PjBL research, including some that I review in Chapter 3, implicate a foundationalist ontology “position [ing themselves] within the umbrella term ‘objectivism’” (Grix, p. 61). This research asserts that “social phenomena and their meanings have an existence that is independent of social actors” (p. 61). Positivist oriented research conducted within PjBL tends to follow the objectivist paradigm that is common in social science research. The challenge with assertions that are derived from positivist PjBL research is that its ontology of foundationalism cannot easily reconcile the inherent social nature of a typical project-based learning reality. This is because PjBL is representative of a reality whereby “social phenomena and categories are not only produced through social interaction but that they are in a constant state of revision” (Bryman, 2001 as cited in Grix, p. 61). That said, I also draw from post-positivist research that places itself between positivism “with its search for regular laws” (p. 85) and interpretivism “with its emphasis on interpretation of meaning” (Sayer, 2000 as cited in Grix, p. 85). Post-positivist research “tends towards critical realism”. It embraces “an approach that believes that while social science can use the same methods as natural science regarding causal explanation (in line with positivism), it also tends to move away from them by adopting an interpretive understanding” (Sayer, 2000 as cited in Grix, 2010, p. 86). In essence, this means that much of the PjBL post-positivist research relies

on interpretive understandings drawn from quantitative methods of data collection and analysis.

This dissertation research used qualitative methods, as there were no variables that could be extracted and investigated. It was not possible to create a control group since the learning environment itself could not be replicated within a controlled lab. Even different projects within the MDM Program's PjBL environment are challenging to compare, since clients, faculty mentors, learners and the nature of the project are unique and distinct from one another. PjBL environments are inherently messy, situated and distinctive, casting doubt on any assertions that emerge in the form of laws or rules that can be transferred to other PjBL environments. PjBL environments do not demonstrate the belief that "knowledge rests on a set of firm, unquestionable, indisputable truths from which our beliefs may be deduced" (Hughes and Sharrock, as cited in Grix, 2010, p. 64). While quantitative methods are common in PjBL research with a leaning towards a post-positivist positioning, knowledge "generated deductively from a theory or hypothesis" (Mack, 2010, p. 7) is not easily transferable.

The above considerations raise a critical question for the present research: Does an orientation away from objectivist research automatically exclude assertions derived from that research, which can be used to draw inference in non-objectivist PjBL investigations?

A common attribute of PjBL investigations is that researchers from varied ontological positions 'borrow' from one another to draw inferences. While this seems to contradict the essentially constructivist foundation of project-based learning itself, the phenomenon is somewhat reconciled with the notions of warranted assertions (Dewey, 1941) and naturalistic generalizations (Stake, 1983) that I will speak to in a later section of this chapter when I take up the challenges of drawing inference in PjBL.

2.3. Interpretivist PjBL Research

As discussed, my own interpretivist research process can be seen as grounded in an anti-foundationalist ontology, epistemologically positioned within constructivism. That is, it is an epistemological position "predicated upon the view that a strategy is required that respects the differences between people…and therefore requires the social scientist to grasp the subjective meaning of social action" (Bryman, 2001, as cited in Grix, 2010, p. 64). I align with Mack (2010), who in the case of interpretivist research states that "research can never be objectively observed from the outside rather it must be observed from inside through the direct experience of the people" (p. 8). My evolving role as an embedded researcher investigating my own work environment is motivated by what Cohen, Manion and Morrison (2013) articulate as a desire to "understand, explain, and demystify social reality through the eyes of different participants" (as cited in Mack, p. 8). I am interested in the type of research where "reality can be studied through the direct detailed observation of people in natural settings in order to arrive at understanding and interpretations of how people create and maintain their social worlds" (Asif, 2014, p. 16).

For these reasons an interpretivist epistemology grounded my research purpose and questions. I was interested in the social reality of how faculty members mentor groups of learners in co-constructing digital artifacts and the learning outcomes supported by that mentoring. The dominant path through which learners learn together is through socially constructing digital artifacts. Social meaning-making and mentoring targeting both groups and individuals in PjBL became the dominant area of inquiry for my research. In contrast to my research, much PjBL research (for example see Thomas, 2000; Helle, Tynjälä, Olkinuora, & Lonka, 2007) are focused on individual learners, for the most part contending with the cognitive and social mechanisms of how individuals learn within team-based project work.

2.3.1. Theoretical positioning of how people learn in PjBL

Part of the challenge evident in the PjBL literature is that researchers tend not to overtly position themselves within a particular epistemological tradition. That's not to say that claiming an epistemological stance binds you to particular methods. However, drawing on Grix (2010), how a researcher "employs a particular method in a particular way" does associate those methods "with a specific set of ontological assumptions" (p. 31). In the case of conducting research at the MDM Program, I aligned my own anti-foundationalist leaning ontology with an epistemological positioning of social constructivism. In the process, I determined whether previous constructivist-oriented theories (social constructivism, situated learning) helped me think through the underpinnings of my research, particularly in consideration of the learning I was to investigate.

Moreover, my epistemological positioning also influenced what data I collected, how I interpreted the data, and the types of inferences drawn from that data. The limitations of what assertions I could draw, for example, were influenced by a common sentiment in PjBL research that findings cannot be generalized across all contexts and populations.

2.3.2. Considering the individual and the group

No matter the epistemological orientation, an ongoing debate in the scholarly and education research literature reflects an attempt to reason how individuals learn together in group learning environments. This is the case even with a more aligned interpretivist epistemology of constructivism and its related positions of social constructivism and situated learning. Within the methodological framework, should the individual or group take priority when designing methods of data collection and methods of interpreting data within collaborative PjBL environments? In my case, what was the best way to describe how people learned together in the MDM Program?

Some literature suggests that collaborative project-based learning environments can reconcile contrasting theoretical views of how learning is manifested by toggling the focus back and forth between the individual and the group (Stahl, 2004). According to Phillips (1995) in his review of a range of constructivist researchers, some constructivists "focus their attention on the cognitive contents of the minds of individual learners, others focus on how the group learns together" (Phillips, p. 6). An aligned perspective proposes that "human knowledge – whether it be the bodies of public knowledge … or the cognitive structures of individual knowers or learners – is constructed" (p. 5). The social constructivist nature of project-based learning, seems to me to provide a stronger theoretical foundation. Rather than argue for incorporating constructivist theories, it may be stronger to take a position that focuses on interpreting project-based learning as an "interactive system...of activity in which individuals participate, usually to achieve objectives that are meaningful in relation to their more general identities and memberships in communities of practice" (Greeno, 1998, p. 6). Those interactive social systems are, according to situated learning, meaningful in context to the activities that individuals and groups engage in.

Stahl's (2004) perspective on situativity proposes that there is no conflict whatsoever. We could interpret the meaning of the group by understanding "the network of relationships constructed by the group discourse" (Stahl, p. 24). Equally so, it is possible to interpret individual participants "by analyzing the behavior and utterances observed in that individual's trajectory within the group interaction" (p. 24). The choice to focus on one or the other depends on the research purpose and questions at hand. Both of Stahl's assertions were warranted for my own investigation, as I will discuss in Chapter 6. The findings of my research indicate that faculty directed their mentoring to the group, but toggled their attention between individuals and the group in an unscripted manner, depending on the nature of what required mentoring in-the-moment, and how individual learners responded to the mentoring.

Epistemologically, constructivism and related theories of social constructivism and situated learning seem to align with Sfard's (1998) theoretical notions of an acquisition and participation metaphor in learning. Her acquisition metaphor (AM) and participation metaphor (PM), support the constructivist and situative assertions that individuals within a group acquire knowledge and also imbue knowing. Her model of both metaphors working together also supports a complementarity between competing theories of (a) cognitive science focused on knowledge acquired "in the head" (AM) and (b) social constructivism where knowing is co-created through groups of learners participating with one another (PM). Similarly, project-based learning proposes an idealized meeting place between competing theories—a context that could be discussed as both knowledge that is acquired by individuals and groups, as well as a type of knowing that can come through participation and interaction. Sfard argues that "most conceptual frameworks cannot be regarded as either purely "acquisitional" or purely "participational". For Sfard as well as for social constructivists (for example, Stahl, 2004; Jonassen, 1999), "the act of acquisition is often tantamount to the act of becoming a participant, and [as such], one can find it difficult to consider AM and PM separately, let alone as mutually exclusive" (Sfard, p. 6).

Similarly, Cook and Brown (1999) with their concept of an epistemology of practice, propose models of how people learn individually and in groups, rather than taking a polarized theoretical stance. Their work reflects a "growing body of work on core competencies [where] one can see serious attention being given to how teams, as well as individuals, do "real work" and how that work can be supported, enriched, and directed" (Cook & Brown, p. 386). I discuss how I drew on and reconceptualized Cook and Browns' (1999) model in the following section.

2.4. A model for teacher-centered research

The interplay between knowledge that is acquired and knowing that comes through social participation in PjBL, is well described in Cook and Brown's model of

learning and their notions of an epistemology of practice. For them, “individuals and groups clearly make use of knowledge, both explicit and tacit, in what they do”, but not everything they know how to do…is explicable solely in terms of the knowledge they possess” (p. 382). The distinction between tacit and explicit knowledge explored by Polanyi and Scha (1983) is further refined by Cook and Brown (1999). Explicit knowledge refers to the epistemic nature of knowledge that is formal, systematic and easily shared, whereas tacit knowledge is more challenging to formalize and communicate. Tacit knowledge is the type of know-how that comes through experience (p. 384).

Their epistemology of practice, is an attempt to bridge tacit and explicit knowledge through the action of knowing in group learning environments. Individual and group knowledge and knowing is an ongoing 'generative dance' (Cook & Brown, 1999) between knowledge that is acquired or possessed and the kind of knowing that can only occur while engaged in an activity where learning occurs. That generative dance is visualized by Cook and Brown in Figure 4. The practice of knowing-in-action inherent in PjBL is represented as an interplay between individual and group tacit and explicit knowledge.

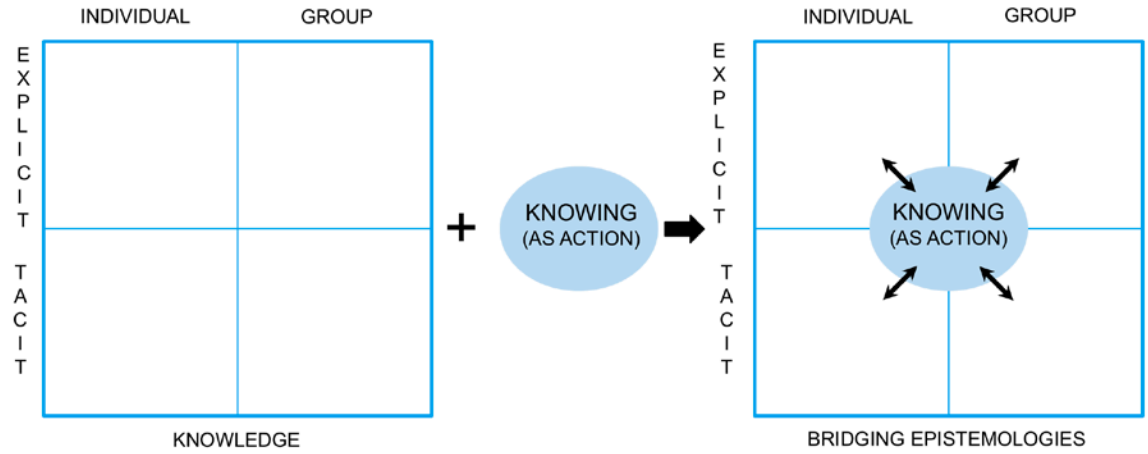

Figure 4: Cook and Brown’s (1999) epistemology of practice. Adapted with permission from Dr. John Seely Brown.

Cook and Brown's model is also aligned with Dewey's epistemology of knowing or "inquiry in a world that is not static" (Boyles, 2006, p. 61). Knowing as "inquiry into things 'lived' by people… experimenting with solving problems such that the action entailed in the solving of problems is [in itself] inquiry" (p. 61). Through Cook and Brown (1999) as well as Schön (1995) we see another resurfacing of an epistemology of practice "that takes fuller account of the competence practitioners sometimes display in situations of uncertainty, complexity, uniqueness, and conflict" (p. 29). Through Cook and Brown's (1999) model (Figure 4), an epistemology of practice can be reconceptualized to describe the faculty-learner interactions at the MDM Program's project-based learning environment.

During a typical project course at the MDM Program, learners rely on their tacit knowledge (know-how) to solve problems. Because of their limited knowledge and know-how, they need to be mentored by faculty. The shift from individual tacit to individual explicit knowledge occurs when faculty mentors challenge learners to articulate and apply the knowledge they possess in new contexts and situations. Making knowledge explicit helps learners increase their understanding of each other's processes, heuristics, and roles in the project.

In regard to Cook and Brown's model, the tacit knowledge possessed by the MDM student team includes group genres that they learn together in previous semester classes. A particular tool learners use to solve a problem in situ is an example of a group genre. MDM faculty challenge the group to draw from shared group genres and apply them to solving problems in the context of their projects and in-the-moment as they appear. Group genres include visual maps used to solve specific design problems, tools to manage the team and client, and Agile methodology (see Appendix A) to manage the project. As Cook and Brown (1999) propose "the body of knowledge of a group is 'held in common' by the group" (p. 386). An example of a group genre are the Rules of Play (see Appendix B), which consist of the rules that the group agrees upon as either acceptable or unacceptable behaviors. For example, arriving on time to agreed upon team

work hours might be a rule of play. Importantly, the rules generated are “possessed by groups, not by individuals” (p. 386). Group tacit knowledge is supported and encouraged by MDM faculty mentors through their interaction with the project, client and team over time.

What bridges individual and group tacit and explicit knowledge is the knowing that can only come through action. In the MDM program, action involves co-constructing the digital media artifact, contending with the management of the client, project and the team. Vickers (1976) proposes that "every human group has not only its own set body of knowledge, but its own ways of [knowing]” (as cited in Cook and Brown, 1999, p. 386). MDM faculty mentors support the development of learner expertise through their interactions with one another, making explicit the individual and group tacit knowledge in order to solve project problems that only emerge through the act of engaging with co-construction of the digital artifact—through individual and group action.

2.5. Bridging theory and practice with Action Research

According to Grix (2010) claiming an ontological position is akin to answering the question: “What is the nature of the social and political reality to be investigated” (p. 59)? In the case of the MDM Program, the social reality I investigated is a project-based learning environment. The political reality was defined by my choice to investigate how colleagues mentor learners in my own workplace. While I discuss in detail in Chapter 4, the fit of an Action Research methodology to my study, in this section I briefly address this to provide continuity with the description of the ontological and epistemological assumptions underlying my research as discussed above.

My impulse to conduct research was to understand how the investigative process itself might increase my understanding of the practice of mentoring. Action Research provided a fit with my purpose to understand and document practice in a workplace environment. While it is important to differentiate between the use of Action Research in

educational versus organizational contexts, “Lewin (1946), the pioneer of action research, emphasized that action research goes beyond change alone since it generates knowledge about a social system through the process of change” (Badger, 2000, p. 202). The methods themselves serve multiple purposes: to gather and analyze data and then to reflect on the data for the potential of understanding practice. My research forms part of a type of scholarship that documents and analyzes “an epistemology of reflective practice” (Schön, 1995, p. 34). The notion of research that propagates reflective practice also aligns with Lewin (1946), who described reflective practice as being an essential characteristic of Action Research (p. 34).

2.5.1. The challenges of drawing inference across PjBL environments

Once I considered employing Action Research, I was challenged to think about how the research I conducted would have meaning and value beyond the specific context of the MDM program both to practice and to scholarship. In the remainder of this chapter, I will discuss the challenges of drawing inference across PjBL environments and propose solutions to some of those challenges based on Dewey’s (1941) concept of making warranted assertions and Stake’s (1983) notion of naturalistic generalizations.

Carrying previous theories ‘over’ into other PjBL environments and constructing new knowledge claims from my current research posed some inherent challenges in describing how people learn in project-based learning environments.

As Stake and Trumbull (1982) assert “in the research community and elsewhere, the general expectation is that the purpose of research is to produce formal generalizations which can then be used by practitioners to guide their own practice in their own particular situation” (p. 2). Nolen and Talbert (2011) propose a contrasting view. Qualitative research doesn’t lead to “prescriptive findings but rather to asserted outcomes that are carefully communicated to the reader within the context of the research design and experience” (p. 4).

Discipline specific contexts

In PjBL research in general, building theory from previous assertions is challenging even across other PjBL environments that may align through a social constructivist perspective, because it is difficult to apply any generalizations to newly situated ones when the conditions, content, learners, teacher roles, assessment, learning goals, design of learning, etc. are uniquely different. In PjBL, like other situated environments, "the subject matter concepts and principles ... tend to be embedded in the contexts of their activity settings" (Brown, Collins, & Duguid, 1989, p. 37). This makes it difficult to generalize from any empirical research conducted within PjBL environments. Moreso, as Thomas (2000) argues, "such projects are focused on questions or problems … [that] drive students to encounter (and struggle with) the central concepts and principles of a discipline" (p. 3) which, are specific to that discipline.

Finding common characteristics of PjBL environments

Thomas' (2000) review of the field of PjBL also reveals that "the variety of practices under the banner of [project-based learning] make it difficult to assess what was and what was not P[j]BL, and whether what you were observing was a "real project" (p. 2). What constitutes an actual project in a study needs to be carefully described for researchers to properly understand the PjBL context fully and I have tried to do this in the previous chapter. This will help investigators draw from assertions in one environment and apply them to the one they are investigating. Understanding a PjBL context is challenging because the practice of providing a rich description, although part of the methodological process of the Case Study has generally not been applied in PjBL research studies. This makes it difficult for researchers to build on the work of others. In contrast, thin descriptions (Ponterotto, 2006) are often attributed to the constraints of space allotted for research articles.

2.5.2. Solutions to the problems of inference in PjBL research

In order to propose solutions to the potential confusion that arises when assertions are transferred from one PjBL environment to another, I faced a similar challenge to that which many other qualitative researchers have faced. While leveraging assertions drawn from PjBL research is challenging across other PjBL environments, there is precedence in doing so. The solution of how to contend with context-specific assertions in research has manifested across much of the qualitative research literature. In the context of this investigation I will discuss what I see as three inter-related solutions first proposed by Dewey (1941) with his notion of warranted assertions, then further elaborated by Stake (1983) with his concept of naturalistic generalizations and Mayring (2007) with his idea of argumentative generalizations.

Warranted assertions

Dewey's warranted assertions were a challenge to the long-standing view of epistemology itself. For Dewey "knowledge is not the focal point of epistemology … knowing is" (p. 8). A simplified version could read 'whatever assertions I make in my own experience as researcher are warranted'. While the notion of generalizing from research might be motivated by our propensity to create or extend theory, are we relegated to using theory simply to defend arguments we wish to make in our current investigations?

In the case of my own investigation, I am not building from previous PjBL theories in order to test "a theory in the field … but to build theory from the data" (Grix, 2010, p. 108). Guided by my interpretivist lens the purpose of my PjBL research is to increase my understanding of a particular characteristic of PjBL in my own unique environment. (Specifically, how faculty mentor self-regulation.) Any assertions that I draw from the data are first and foremost for the purpose of drawing awareness to the practice of mentoring in my own researched environment. These claims are aligned with

Dewey's notion of warranted assertions, in that the "action entailed in the solving of problems is inquiry itself and warranted in the assertions made about the solved problem when it is solved" (Boyles, 2006, p. 9). Knowledge claims can be made "but without commitment to universality and without commitment to linguistic correspondence to extra-linguistic fact" (p. 9). Any assertions that I make from my own investigation, may exist as propositions that other researchers might infer for other PjBL research environments. In addition, like Dewey (1941), I am "arguing for knowers as people who can defend their claims to knowledge [a form of epistemic responsibility]" (p. 9) within the context that only they understand. The knowers Dewey refers to are those individuals embedded within the research environment itself—the researcher/practitioner.

Naturalistic Generalizations

Stake (1983) argues that "the naturalistic researcher seeks to present selected raw data-portrayals of actual teaching and learning problems, witnessings of observers who understand the reality of the classroom, words of the people involved" (p. 3). Further, that "these raw data provide the reader with vicarious experience which interacts with her existing naturalistic generalizations, formed previously from her particular experience" (p. 3). For Stake the generalizations that are made form a continuum between the researcher who documents the research and the reader who experiences knowledge claims 'vicariously' through the researcher. Stake suggests generalizations "stimulate discussion and dialogue among practitioners, serving as a springboard to further examine the situation portrayed in the report" (p. 3).

Argumentative Generalizations

Stake's notion of naturalistic generalizations has its more contemporary proponents. Mayring (2007) proposes a method of argumentative generalization that asks "what aspects of [my] results are generalizable to what new situations" (p. 6)? In the context of my own investigation, the role of my own research is, in part, to determine

what characteristics of my particular PjBL research can be useful and generalized across other PjBL environments. As I turn to the literature in the next chapter, it will be equally important to locate congruent research whose assertions can be applicable to my own PjBL environment.

Chapter 3. Review of Literature

3.1. Introduction

I engaged in a review of the literature with the purpose of more deeply understanding mentoring with a key learning outcome common to many PjBL environments— 'student ownership' of the problem-solving process (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991; Helle, Tynjälä, & Olkinuora, 2006; Stefanou, Stolk, Prince, Chen, & Lord, 2013). Borrowing social scientist researcher Luker's (2008) idea of a 'research daisy', I attempted to locate research articles within three intersecting knowledge domains (see Figure 5 below).

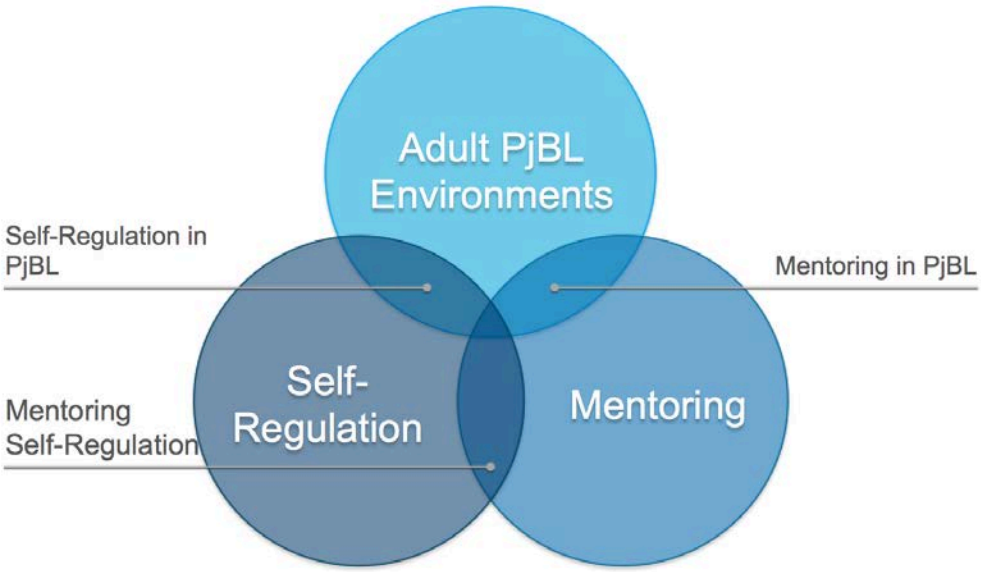

Figure 5: Research daisy of intersecting zones of inquiry using AR as a methodology.

Locating research conducted in contexts that matched the MDM Program's situated environment was not possible. I was unable to locate any PjBL research in the realm of game development that investigated any issues or experiences of learners

interacting with a real client. I was unable to find Action Research investigations within PjBL that investigated group mentoring of self-regulation. Nevertheless, some research existed at more than one intersection of my daisy and provided assertions that were transferable to the PjBL environment of MDM. Knowledge claims from previous research were useful in developing a deeper understanding of PjBL, mentoring and self-regulation in adult-oriented environments in general, while also informing my research methods and how I made warranted assertions from the data that I collected.

3.2. Inclusion criteria

I mainly included research (both within and outside of digital media environments), that investigated mentoring and self-regulation in post-secondary project-based learning courses or programs.

3.3. Structure of this chapter

I have organized this chapter into three sections. I will first present a review of the research literature in PjBL. Here I will show that PjBL research has mainly focused on the individual learner to afford learner motivation, learner-defined objectives, and ownership of the problem solving process. Secondly, through a review of Whitehead and Fitzgerald's (2006) Action Research study, I will reframe the primary teaching interactions in the MDM Program's PjBL environments as mentoring. Third, I will review Stefanou, Stolk, Prince, Chen, & Lord's (2013) comparative investigation of project versus problem-based learning in undergraduate settings to argue that self-regulation is a fundamental requirement of PjBL. In this third section, I will also draw from literature that contends with mentoring self-regulation in PjBL environments, focusing on Helle, Tynjälä, Olkinuora, & Lonka's (2007) experimental study. Their investigation provides relatable characteristics of mentoring in professionally-oriented educational programs and contributed a framework for the methods that I used in my own investigation.

3.4. Review of the research literature in PjBL

In my review, I discovered that there is a scarcity of PjBL research in undergraduate and graduate learning environments. Published research on PjBL is mostly situated at the K-12 level. The main focus of the research is on deepening an understanding of PjBL environments to support learner-centered practices and specific learning outcomes. Grant's (2002) review of published work, uncovers a multiplicity of discipline-specific project-based learning models that typically "vary in both context and implementation" (p. 66). A comprehensive literature review of PjBL in undergraduate and graduate environments by Helle et al. (2007) reveals that most of the "articles analyzed were mainly course descriptions focusing on the implementation of project-based courses" (p. 306).

It is difficult to speak of PjBL environments let alone PjBL research as a cohesive whole. However, many PjBL environments have a common theoretical foundation that can be traced "as far back as the early 1900s" (Grant, p. 66). A shared premise is centered around John Dewey's notion of "learning by doing" (p. 66)— a sentiment "reflected in constructivism and constructionism" (p. 66). Dewey believed "that students develop personal investment in the material if they engage in real, meaningful tasks and problems that emulate what experts do in real-world situations" (Krajcik & Blumenfeld, 2006).

Hutchison's (2015) report summarizes a common sentiment of the field suggesting that while no common definitions of PjBL are evident in the literature "project-based learning empowers learners to collaborate in teams, mentored by their teachers, as they research real-world questions, pose solutions to real-world problems, and design real-world products in a rigorous way" (p. 2). Meaningful tasks that contribute to the co-construction of iterative prototypes and "culminate in a final product" (Helle et al., 2006, p. 295), are another common trait in describing PjBL environments.

I could not locate any PjBL research that investigated an environment similar to that of the MDM program, where faculty mentor learners on co-constructed video game projects initiated by real-world clients. However, what I learned from the literature was that learning outcomes that include aspects of self-regulation are common in PjBL environments described in the literature. This is true, for example, in work reported by Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar's (1991), Stefanou et al. (2013), and Helle et al. (2007). Although the research literature is predominantly focused on the individual learner, I still gained insights on PjBL's propensity to afford learner motivation, problem-solving, and learner-driven objectives.

3.4.1. Learner-focused research

The dominant research literature of PjBL, as noted above, focuses on learner cognitive mechanisms and the type of learning that transpires. In sharp contrast, there are only a few examples of research that pays any attention to the teaching interactions that transpire in PjBL contexts. For example, although not the central focus of their investigation, Helle et al. (2007) at least discuss the "interplay between teacher regulation and student self-regulation of learning" (p. 398). They identify that some challenges "encountered in project-based learning reported in the literature" are a direct result of "an incompatibility of student self-regulation and teacher regulation of the study process resulting from the teacher handing over too much responsibility to the student" (p. 399). Yet, the impacts of teachers 'over-regulating' learners in PjBL seems not to have been investigated.

The question of 'how much' to regulate learners points to the challenges that faculty at the MDM Program persistently contend with. In Chapter 6, I address the impulse for faculty mentors at the MDM Program to diminish the amount of regulation particularly if learners demonstrate an ability to manage one another, the client and the project.

3.4.2. Learner motivation

Another common thread in the PjBL research literature is learner motivation. Early definitions of PjBL were primarily based on research that investigated its impact on motivation and engagement in children and young adults (Blumenfeld et al., 1991; Paris & Paris, 2001; Hung et al., 2012). Most papers cite (over 2000 references according to Google Scholar, November 29th, 2015) Blumenfeld et al.'s (1991) seminal paper *Motivating Project-Based Learning: Sustaining the Doing, Supporting the Learning*, the first sentence of which is "How can I motivate children?" (p. 369). PjBL typically challenges learners to contend with tasks as they emerge through co-constructing projects together. These “open-ended tasks … promote thoughtful engagement includ[ing] opportunities for students to make choices, exercise control, set challenging goals, collaborate with others, construct personal meaning, and derive feelings of self-efficacy as a consequence of their engagement with the task” (Paris & Turner, 1994 as cited in Paris & Paris, 2001, p. 94). The inherent quality of PjBL has typically demanded teams of self-motivated learners co-constructing projects that "involve the solution of a problem" (Adderley as cited in Helle et al., 2007).

Hung, Hwang and Huang (2012) assert that “many scholars considered Project-Based Learning as an excellent form of instruction that encouraged the self-learning of students” (p. 368). Hung et al. investigated the co-construction of a digital storytelling project with elementary students using a control and experimental group and applying a learner motivation instrument. Through mixed methods research, they discovered quantitatively that the “performance of the experimental group was … superior to that of the control group” (Hung et al., 2012, p. 375) and that “the interview results conclude that the project-based digital storytelling approach not only enhanced the students' learning achievement and problem-solving competence, but also improved their learning attitude and motivation” (p. 376). Hung et al.’s paper demonstrates a common assertion of researchers that PjBL leads to enhanced intrinsic motivation. Like others, Hung et al. also did not investigate the role of the teacher related to these findings.

I was able to locate one research article that looked at the role of the teacher in some depth by investigating "the relationship between teacher and student intrinsic motivation in project-based learning" (Lam, Cheng, & Ma, 2009, p. 567). Lam et al.'s research data were collected through evaluation questionnaires following a one-semester "project-based learning program". The investigators reveal that "teacher intrinsic motivation predicted student intrinsic motivation directly as well as indirectly through the mediation of instructional support" (p. 567). Lam et al.'s investigation focuses as much on the teacher as the learner. Drawing from Ryan and Grolnick (1986), they found that "non-controlling instruction resulted in greater interest and conceptual learning in students when compared with controlling instruction" (as cited in Lam et al., p. 570). For Lam et al., the degree of autonomy teachers afford learners directly impacts their motivation (p. 570). Through Ryan and Grolnick we learn that "the more students perceived supported autonomy in the classroom, the higher their reported self-worth, cognitive competence, internal control, and mastery motivation" (p. 552). Referencing Ryan and Deci (2000), Lam et al. posit "that any social contexts that promote a sense of interpersonal relatedness are likely to facilitate intrinsic motivation" (p. 571).

3.4.3. Ownership of the problem

Related to the affordance of learner motivation, Jonassen (1999) believed that one key to "meaningful learning" in constructivist environments is learner "ownership of the problem or learning goal" (p. 219). Jonassen's insight resonates with a common theme in the literature, that PjBL environments afford problem-solving opportunities for learners. Helle et al. (2006), for example, assert (as did Blumenfeld et al., 1991) that one crucial outcome of PjBL environments includes "problem orientation, that is, the idea that a problem or question serves to drive learning activities" (p. 290). Jonassen (1999) defines a problem as "an unknown that results from any situation in which a person seeks to fulfill a need or accomplish a goal" (p. 66), and that problems run "along a continuum between well-structured and ill-structured problems" (Jonassen, 1999 as cited in Tawfik & Jonassen, p. 66, 2013). Unlike PjBL environments, "most problems encountered in formal education are well-structured problems [that] engage a limited number of rules

and principles that are organized in a predictive and prescriptive arrangement; possess correct, convergent answers; and have a preferred, prescribed solution process" (Tawfik & Jonassen, 2013, p. 386). Tawfik and Jonassen assert that in these more formal environments, very little autonomy over the problem-solving process is present.

In the MDM Program's PjBL environment, problems that learners encounter tend to fall on the ill-structured end of Jonassen's (1999) continuum. This is because projects are initiated by a client-driven problem that a team of learners has to solve through the co-construction of a digital media artifact. Learners must first identify the problem to solve. They then propose solutions, that first manifest as ideas, proposals, or pitches made to the client. These solutions are negotiated with the client but the problem's tangible solution tends to emerge as a series of prototypes (paper, physical model, digital). The process of solutions to problems manifesting as prototypes, is iterative. After each prototype is presented to the client, the learners receive feedback, then refine some of its features, abandon others and add new ones. The resulting digital artifact generally aims to satisfy the client's interrelated needs for increased brand exposure, revenue, social credibility in their community of practice, association with a University, exposure to potential talent, and the development of a technological innovation.

In the research that assumes a constructivist perspective, solving problems has also been connected with learner motivation. Specifically, learner motivation increases based on the "unstated goals and constraints … solution paths, [that] require learners to make judgments about the problem and to defend their judgements" (Jonassen, 1999, p. 219). At the MDM Program, defending their choices demands that learners investigate all aspects of the client's need and identify problems that need solving. In doing so they have to understand why the client wants a particular artifact, who it is targeted for, and the greater context of its use. Learners also need to re-articulate what they think the problem is in the form of propositional statements. The process of solving problems in the MDM Program is aligned with Jonassen's (1999) assertion that to engage learners deeply, a problem needs to be ill-structured "so that some aspects of the problem are emergent and

definable by the learner" (p. 222). For Jonassen "without ownership of the problem, learners are less motivated" to solve problems (p. 219).

In summary, solving problems has been identified as a common attribute of much of the PjBL research literature, but the teacher's role in this process has been little discussed.

Another aspect of ownership characteristic of PjBL is that of learner-driven learning outcomes. There are several reasons for this. Firstly, learning outcomes in PjBL environments cannot be constructed without knowing the specific constraints of the project, and without a close examination of "the learner to determine how to design instruction so that it can be readily assimilated" (Ertmer & Newby, 1993, p. 60). Secondly, learner-defined objectives also reveal less of a reliance on the teacher as the sole provider of externally motivated goals, or the reinforcement necessary to ensure that specific learner goals can be achieved. Third, individual learners "bring various learning experiences to the learning situation which can impact learning outcomes" (p. 61).

In relation to the MDM Program, once the projects are more clearly defined in context, faculty work with learners to refine learning goals that reflect more specific competencies directly related to the project's needs and to the learner's career trajectory. On a typical MDM project course, the learner is held equally responsible for the successful articulation and assessment of their own learning goals. This process demands that they self-regulate by managing and documenting learning goals they have committed to achieving throughout the duration of a project course.

Helle et al. (2006) argue more generally that "goals for project-based courses are typically manifold, including mastery of subject content, application of knowledge, critical thinking and communication skills" (p. 306). They also assert that some goals are "poorly conceptualized" (p. 306). These include "communication skills", of which "there is no such thing in a generic sense" (p. 306). Helle et al. (2006) highlight the difficulty in

defining specific learning outcomes in PjBL since most are context specific "varying from one task or job to another" (Aspegren, 1999 as cited in Helle et al, p. 306). So a question for me in this study was: How do faculty mentor the process of developing learner goals, allowing learners control and autonomy, essentially engaging in self-regulation?

Summary

From the PjBL research literature, I learned that most assertions focus on the individual learner. These include a project's propensity to afford learner motivation, learner-defined objectives, and ownership of the problem solving process. Hung et al. (2012) affirm the potential of PjBL to support self-learning. Lam et al. (2009) reveal that the degree of autonomy that teachers provide learners has the potential to increase their motivation amongst other outcomes. How teachers facilitate an environment of 'non-controlling' instruction, however, is not clear.

Much of the research literature along with theories put forth by Jonassen (1999), Blumenfeld et al. (1991) and others reveals the potential for project-based learning to support learner ownership of the problem solving process. It does not however, focus on the teacher's role in that process. Learner-defined goals are shown to support self-regulation, but what of the faculty's role in relation to setting, maintaining and assessing those goals? To help me clarify the role that faculty play when they facilitate project courses at the MDM Program, I turned to the mentoring literature.

3.5. Reframing teaching interactions in PjBL environments as mentoring

A review of the PjBL literature in adult-oriented environments reveals that the role of the teacher remains a compelling 'story' to be told. In examining the literature that could best define how faculty interacted with learners in the MDM Program, I was drawn to the research on mentoring. I looked to the literature for characteristics that described the interaction between learner and faculty as mentor. As Healy and Welchert (1990) contend, it is important to speak of "the essence of mentoring so that it is distinguished from other superior/subordinate interactions" (p. 17).

So what characteristics of PjBL environments support the definition of faculty as mentors? There are a number of characteristics that emerge from the constructivist literature that describe mentoring. These include the context in which learning interactions occur (i.e. a project room). Also important is that mentors represent a body of knowledge that is inter-connected with the existing community of practice they belong to. Finally, mentors support self-reliance and learner-management of the project itself.

3.5.1. The physical and working environment of a PjBL course

The physical and working environment of the project-based learning course place unique educational demands on the MDM faculty in comparison to traditional classroom instruction. During my investigation, most of the daily interactions that took place occurred within the confined space of a project room environment where learners spent 35-40 hours per week together. In the literature, Ertmer and Newby (1993) emphasize that both learner and environmental factors are "critical to the constructivist, as it is the specific interaction between these two variables that creates knowledge" (p. 55). Essential to the constructivist view, according to Bednar et al. (1991) is that "learning always takes place in a context and that the context forms an inexorable link with the knowledge embedded in it" (as cited in Ertmer & Newby, 1993, p. 57).

In my investigation faculty were present physically in a project room. In line with a mentor, they at times acted as witness, observing how learners solved problems and offering feedback if asked. Other times, they responded in-the-moment to questions learners had by drawing from their professional expertise in order to support learners whenever that support was deemed necessary.

The knowledge and knowing generated by MDM learners were centralized around managing three general areas of problem-solving that the environment itself provoked learners to regulate. First were those problems instigated by the ill-structured nature of the project itself, encompassing all the tools that learners used in order to solve those problems. One tool I observed learners to rely on, for example, was the use of psychographic profiles of potential consumers of their product, etc. (see Appendix B). Part of the faculty's role was to re-engage the learner to use tools that they had learned in previous semesters to solve problems that replicated real-world scenarios. This approach aligns with the design of constructivist learning environments since "nearly every conception of constructivist learning recommends engaging learners in solving authentic problems" (Jonassen, 1999, p. 221). The benefit of solving authentic problems is, as Savery and Duffy (1996) assert, that learners "engage in activities which present the same type of cognitive challenges as those in the real world—tasks which replicate the particular activity structures of a context" (as cited in Jonassen, 1999, p. 221).

Problems presented to learners at the MDM Program were authentic because they were initiated by a real-world client. Problems also emerged as collaborative challenges that the process itself provoked, such as learners negotiating ideas and solution states with one another as they co-constructed the digital artifact. Many of these collaborative challenges were incited by the pressure to deliver anticipated outcomes to a client, and the learners' propensity to manage one another, their own time, and their own learning. The same-time, same-place nature of the interactions between learners, clients and faculty were dominant in the MDM Program's PjBL environment.

3.5.2. Representing a body of knowledge

Another characteristic that helped me to refer to faculty interactions with students as mentoring had to do with the body of knowledge each faculty mentor 'carried' with them. The notion of a body of knowledge, was embodied within each faculty, inter-connected to the existing practices of a professional community, and passed onto learners. Healy and Welchert (1990) assert that for the protégé or mentee "the object of mentoring is the achievement of an identity transformation, a movement from the status of understudy to that of self-directing colleague" (p. 17). This movement is entwined with the methods that faculty use to "transmit a complex legacy of professional acumen that reflect their own unique ability to identify salient issues and heuristics in the work environment" (Healy & Welchert, 1990, p. 18).

Faculty at the MDM Program draw from a gamut of heuristics associated with communities of practice, which they pass on to learners, particularly in supporting how learners solve problems within the disciplinary domain. For Healy and Welchert, through a mentoring relationship "protégés integrate aspects of this professional approach into their repertoire" (p. 18). The goal of the relationship with the mentor is to "become reciprocal as their practice incorporates and thereby perpetuates essential elements of their mentor's professional legacy" (p. 18).

3.5.3. Supporting learner self-reliance

From my investigation, I found that when MDM faculty mentors passed on their professional legacy, it was not focused on mapping their own cognitive structures onto the learners. It was an attempt to pass on that characteristic of their legacy as grounded in self-reliance. This is akin to what Bransford (2000) refers to as supporting a learner's "[ability] to retrieve relevant knowledge" (p. 32). The purpose is to challenge learners to persistently improve their "ability to monitor [their] approach to problem solving" (p. 50). As will be seen in the discussion of the findings of this study, MDM faculty mentor interactions supported learners to develop their own heuristics, moreso than modelling

the way the mentor would have solved a problem. Klasen and Clutterbuck (2012) argue that one of the roles of mentoring is to "[guide] and [encourage] individuals in the self-reliant analysis and solution of their problems and opportunities" (p. 16). In this way the fundamental purpose of mentoring learners at the MDM Program, I found, was to support self-reliance: a crucial aspect of self-regulatory behavior.

3.5.4. Regulating learner management of the project

I have already discussed that the learning context of PjBL at the MDM Program proposes a unique kind of relationship between faculty and learners. This relationship hinges on the ability of the faculty to continuously 'hand back' the responsibility of emergent design problems to the learner. This, despite the fact that faculty possess a body of knowledge and experience whereby they could simply solve problems for the learners. I argue that defining faculty as mentors remains dependent on their propensity to support learner self-regulation. The reinvention of the faculty supervisor as mentor in the MDM Program is supported in the literature by Klasen and Clutterbuck's (2012) definition of mentoring as

> the process by which one person (the mentor) encourages another individual (the mentee) to manage his or her own learning so that the mentee becomes self-reliant in the acquisition of new knowledge, skills, and abilities, and develops a continuous motivation to do so (p. 16).

The nature of the relationship between faculty and learners at the MDM Program is further supported by Parsloe (1992) who defines the purpose of mentoring "as that of helping and supporting people to manage their own learning" (as cited in Hattingh et al., p. 2005, p. 41). The emerging definition of faculty as mentor in PjBL is inextricably tied in with supporting self-regulation.

3.5.5. An Action Research investigation of Mentoring in PjBL

Most of the literature of mentoring in PjBL contexts references the domains of education and nursing in health sciences. Nevertheless, some valuable insights could be

drawn. In Whitehead and Fitzgerald's (2006) work, researchers explore "the development of a generative, research-based approach to mentoring" while training students to be teachers. They draw on data "from mentors, trainees and pupils using video recordings of participants' classroom practice to stimulate reflective dialogue." (Whitehead and Fitzgerald, 2006 p. 37).

Throughout the course of the research the authors refer to a new form of mentoring as generative. Their generative model takes into account two important characteristics of mentoring directly related to my own investigation: context specific knowledge and knowledge that emerges from "reflective dialogue between mentors and trainees as they planned and analyzed lessons for which each took responsibility" (p. 42). The reflective dialogue between mentors and mentees demonstrates typical "strategies utilized by constructivists" that include "social negotiation (debate, discussion, evidence giving)" (Ertmer & Newby, 1993, p. 58).

Based on their data analysis, Whitehead and Fitzgerald assert that when mentors are "challenged to articulate what usually remained as tacit experience-based knowledge", it helps [them] to know what [they] did not know that [they] knew". The cyclical spiral of reflective dialogue the investigators used in this process mirrored the one I decided to use in my own investigation. Their methods consisted of video recorded mentoring sessions followed by a discussion of that recording between mentor and mentee, providing what the researchers believed was a more impactful and engaging learning process with multiple benefits, including self-regulatory behaviors.

Like Whitehead and Fitzgerald (2006), I used the idea of video recorded mentoring sessions in my study. I did not place myself in the position of mentor to the faculty member participants, but instead videotaped faculty sessions with their student teams. Faculty participants then watched those recorded mentoring sessions and discussed them with me, the researcher. This method relies on the benefits that Schön (1995) refers to as reflection-on-action. Even though my primary purpose was to

document mentoring strategies, a key benefit of reflection-on-action is that it provided the faculty participants, in my case, with a documented reflection of their mentoring so that they could choose to keep, change, and/or refine their approach.

Whitehead and Fitzgerald (2006) also assert that mentors engaging in reflective practice "changed from observing the lesson as detached outsiders to becoming involved insiders, stakeholders in their own training." (p. 43). One of the more relatable quotes from a participant in Whitehead and Fitzgerald's investigation affirms that

> the opportunity to sit and watch one's own practice is rare and actually having to comment on the reasons for including certain activities, the choices you made and the decision making process behind classroom management strategies is actually quite complex forcing you to acknowledge at a conscious level why you do certain things and whether they are effective or not (p. 43).

During the final research interviews, MDM faculty mentors in my own investigation described similar value in the reflection of their mentoring.

Whitehead and Fitzgerald's investigation affirmed for me that Action Research was the most suitable methodological framework to support an investigation of mentoring at the MDM Program. Their investigation, like mine, was not solely concerned with understanding how faculty mentored self-regulation, but equally interested in creating a process of reflection-on-action through which faculty mentors could better understand their practice.

3.5.6. Summary

In addition to inspiring my methodological orientation and methods, Whitehead and Fitzgerald's (2006) investigation offered some key insights on the role of reflective dialogue to deepen a practitioner's understanding of mentoring.

The role of the teacher-as-mentor in the literature is aligned with many of the interactions between faculty and learners at the MDM Program. One of the key defining aspects of mentors is their propensity to support self-regulation in their learners.

Some of the mentoring literature provided glimpses as to what characteristics of self-regulation are mentored. For example, self-reliance emerged as a key behavior that mentors encouraged learners to express in managing their own learning. But what other characteristics of self-regulation do MDM faculty mentor? To answer this question and further operationalize self-regulation as a critical aspect of what MDM faculty mentor, I searched for research that investigated self-regulation in PjBL environments.

3.6. Self-Regulation in PjBL Environments

The realization of self-regulation as a behaviour to be mentored, was in part due to the identification of self-regulatory behaviors in pre-research interviews conducted with members of the indie video game industry in Vancouver (see Chapter I for a description of these interviews).

The literature on self-regulation within post-secondary PjBL environments is limited, however some sources from the field are useful. Many reviews of research conducted within PjBL environments focus on characteristics of self-regulation including motivation and agency. I was able to draw some warranted assertions from an investigation by Stefanou et al. (2013), and another by Helle et al. (2007), even though their post-positivist orientation was different from my interpretivist one.

Besides providing us with a compelling empirical study contrasting an investigation that essentially compared self-regulated learning strategies in problem versus project based learning environments, Stefanou et al.'s (2013) article also presents some important definitions of self-regulation. Helle et al.'s (2007) investigation is aligned in so far as it is the only article that I could locate that investigates adult self-regulation in

a project-based learning environment with a real-world client. Both articles proved useful in helping me to operationalize self-regulation in my own investigation.

Prior to a review of Stefanou et al. (2013) and Helle et al. (2007), I reviewed self-regulation research in predominantly non-PjBL environments as well as definitions of self-regulation within and outside of PjBL environments. I did so, in order to relate common assertions in the self-regulation research literature with those drawn from project-based learning environments.

3.6.1. Self-regulation research in predominantly non-PjBL environments

In his re-examination of the field of self-regulation studies, Zimmerman (2008) points to a special issue of *Contemporary Education Psychology* (1986) that attempts to "integrate under a single rubric research on such processes as learning strategies, metacognitive monitoring, self-concept perceptions, volitional strategies, and self-control" (p. 167). Some of the researchers involved in this process include Monique Boekaerts, Lyn Corno, Steve Graham, Karen Harris, Mary McCaslin, Barbara McCombs, Judith Meece, Richard Newman, Scott Paris, Paul Pintrich, and Dale Schunk (p. 167). In Zimmerman's review he questions "whether teachers can modify their classrooms to foster increases in self-regulated learning among their students" (p. 169). Arguably, in the literature of PjBL, self-regulation is persistently articulated as an assumed outcome. In my investigation, however, I did not want to necessarily presuppose that the strategies MDM faculty mentors employed were solely motivated to support self-regulation. I preferred to openly discuss the strategies that faculty employed and later, through re-examining the data uncover if indeed, they pointed to supporting self-regulatory behaviors.

For Zimmerman (2002), investigating self-regulation is of ongoing importance because "research on the quality and quantity of students' use of self-regulatory processes reveals high correlations with academic achievement track placement (Zimmerman & Martinez-Pons, 1986 as cited in Zimmerman, p. 69). The impulse to investigate how

faculty at the MDM Program supported self-regulatory behaviors was motivated not as much by academic placement as it was by job placement. In Chapter 5, I detail the job placement orientation as reflected in the pre-research interviews I conducted with members of the video game industry, all of which documented that characteristics of self-regulatory behavior are prized in new industry recruits.

3.6.2. Definitions of self-regulation within and outside of PjBL environments

Stefanou et al. (2013) refer to self-regulated learning as "student control of the learning process" (p. 110). I discovered common elements of the definition tracing back to Zimmerman (2002) who defines self-regulated learning as "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (as cited in Stefanou, p. 110). The cyclical adaptation of actions towards the attainment of personal goals was a common feature of the PjBL environment I investigated at the MDM Program. This was demonstrated particularly in-between mentoring interventions where individual learners had an opportunity to shift or change their behavior after interacting with their faculty mentors. During mentoring sessions learners critiqued the artifact and their role in its co-construction, in order to improve upon their approach of solving new problems in the subsequent prototype. The retrospective occurred after presenting their work to and receiving feedback from their project's client. Interactions with the client persistently challenged learners to adapt their approach to solving problems that would inform their next prototype.

3.6.3. Project-based learning supports self-regulatory behaviors

Many scholars consider PjBL an excellent form of instruction to encourage the self-learning of students (Chang & Lee, 2010; Gerber, Cavallo, & Marek, 2001; Glover, 1993; Green, 1998; Moursund, 1999; Scott, 1994 as cited in Hung et al., 2012). Blumenfeld et al.'s (1991) seminal paper on PjBL reveals that self-regulation is a key result of learners actively solving problems together. Zimmerman (2002) attests that a

learner's "capability to self-regulate is especially challenged when they undertake long-term creative projects, such as works of art, literary texts, or inventions" (p. 66). English and Kitsantas (2013) citing Mergendoller et al. (2006), further claim that in order "to effectively engage in P[j]BL, students" need to become "responsible for their learning and actively participate in the processes of constructing knowledge and making meaning" (p. 129). For Mergendoller et al., learners transform as active learners and "develop self-regulated learning skills" (p. 129).

Both Helle et al. (2007) and Stefanou et. al. (2013) demonstrate an epistemological orientation towards objectivism—both conducting an experimental study in PjBL environments. Helle et al.'s study, however, is the closest equivalent to the type of learning conditions experienced at the MDM Program. Helle et al. (2007) investigate "whether students scoring low in self-regulation of learning experienced 'friction', an incompatibility between student self-regulation and the demands posed by the learning environment" (p. 397). Research questions are concerned with the "extent students are motivated by a model of work-based project learning", how "the project model promotes different kinds of cognitive processing" and whether or not "cognitive or motivational effects are a function of student self-regulation" (p. 400).

Helle et al.'s (2007) study consists of an experimental and control group. The experimental group was assigned with a project course assignment commissioned by an authentic client. The experimental group was matched with a "non-equivalent" control group that did not have a project-based component. Data was collected using two questionnaires at the beginning and end of the courses. Interestingly the researchers also conducted open-ended interviews at the end of the course to understand the student's experiences of each course (p. 403). Students were asked if they found the course to be motivating, and why or why not (p. 403). Findings revealed that a work-based project course had "a substantial motivational impact…benefiting especially those students who scored low in self-regulation" (p. 397). An important part of the analysis included a better understanding of teacher regulation since, in their own review of the literature, Helle et

al. (2007) reveal that teachers tend to hand over “much responsibility to the student” (p. 399).

Stefanou et al. (2013) compared self-regulated learning strategies in problem and project-based learning environments. They wanted to determine whether or not student self-regulation outcomes were different in each environment. (p. 109). While student self-motivation and self-regulatory behaviors were not statistically different in either of the two settings, (p. 109), they found that learners in the PjBL environments demonstrated

> higher levels of elaboration, critical thinking and metacognition, higher perceived autonomy support, or the degree to which they perceived their instructors provided them with supportive opportunities to act and think independently compared to students in the problem-based courses (p. 109).

Stefanou et al.’s findings reveal important insights applicable to my own investigation. The researchers show “evidence of the capability of [PjBL] environments to foster the adaptive behaviors of elaboration, critical thinking and metacognitive self-regulation” particularly “relative to their peers in the PBL [problem-based learning] environment” (p. 117). Investigators affirm that “real-world, ill-defined, complex, open-ended projects in the PjBL courses” spark an “increased higher-level cognitive strategy use among students” (p. 117).

Assertions drawn from Helle et al. and Stefanou et al. argue that increased expressions of self-regulation occur when learners are engaged in the challenges of solving design problems and co-constructing artifacts in PjBL environments.

3.6.4. Teacher self-regulation

That PjBL supports student self-regulation is a consistent assertion throughout the literature. Greeno (1998) touches on the transforming role of the teacher in constructivist oriented environments who “often refer to the shift from being a "sage on the stage" to being a "guide on the side," (p. 19). The metaphor could be extended to PjBL mentors

with the proviso that “the kind of leadership that constructivist teachers provide is less directive and more interactive than it is when instruction is oriented primarily toward acquiring skills, vocabulary, and other routine knowledge” (p. 19). As Jonassen (1999) and Stefanou et al. (2013) both claim, the ill-structured problems that form a part of PjBL environments not only demand a different kind of teacher-learner interaction, but teachers need to approach their practice in a completely different manner.

While the role of the mentor is not discussed in the Stefanou et al. (2013) study, it is revealed that activities of the instructors “[fell] on the more loosely teacher-regulated end of Vermunt and Vermetten’s (2004) range” (p. 111). I interpreted this to mean, that in their particular investigation, learners took more responsibility for their own learning. In Chapter 6, I discuss an ever-changing continuum identified by Vermunt and Vermitten, where MDM faculty mentoring “can be placed on a dimension ranging from strongly teacher-regulated to shared regulation to loosely teacher-regulated” (p. 363). Within the MDM Program’s PjBL environment, I observed that the challenges faculty mentors encountered were related to the changing degree of self-regulation they offered learners over a 13-week project cycle.

3.7. Conclusions: Towards an Action Research methodological approach

There were some key insights gained from a review of the research literature primarily focused at the intersections of mentoring, self-regulation and PjBL. The literature supports assertions that faculty at the MDM Program’s project-based learning environment can arguably be characterized as mentors. Because the vast majority of research and scholarly contributions to PjBL is focused on the learner, it was affirmed that focusing my investigation on the faculty mentor would add a necessary contribution to the field.

I turn now, in Chapter 4, to Action Research as a viable methodological

framework that best supports the research of and enhancement of faculty mentoring in the MDM Program. Herr and Anderson (2005) claim that "the definition [of Action Research] that a researcher chooses should be made clear in a dissertation" because it "will then determine the kinds of epistemological, ethical, and political decisions a researcher will have to make throughout the dissertation study" (p. 8). The two Action Research articles in my review of the literature are rooted in a post-positivist epistemology. While neither align epistemologically with my own investigation, they nonetheless inspired a review of Action Research traditions to uncover commonalities between them, in support of my investigation. What seems consistent throughout the review of the Action Research literature is that investigations are supportive of multiple research purposes. Their goals are to generate knowledge about the learning environment, while "at the same time, attempting to change it" (Lewin, 1946). I could therefore move forward from a review of the inter-related research literature, knowing that Action Research would support the research of mentoring within PjBL.

Chapter 4. Methodological Alignment of AR with PjBL

The first section of my methodology chapter will discuss the theoretical underpinnings of Action Research as it aligns with my investigation of the MDM Program's PjBL environment. I will briefly highlight sixteen components guided by McKernan's (1986) attempts to unify different Action Research traditions through examination of "central concepts, which give structure, unity, and understanding to the action-research process" (p. 185). I will extract these central concepts, relate them to various historical traditions, discuss their underlying assumptions about how we come to know, and provide examples of how they inform procedures, methods, findings and assertions.

I claim that Action Research as a methodology is aligned epistemologically with an investigation of faculty mentoring at the MDM Program's PjBL environment. To better understand the mentoring practice of faculty mentors by investigating their own practice, I also draw from Dewey's (1941) assertions of the necessity of "teachers as researchers" (as cited in McKernan, 1986, p. 176). Action Research supports a long-held view that the "proper role of the teacher was to investigate pedagogical problems through inquiry" (McKernan, p. 176). Through inquiry, it is argued, the teacher also transforms into a reflective researcher. The decision to capture the strategies that MDM faculty used to mentor learners through a reflective process led to my adoption of the methods demonstrated by Whitehead and Fitzgerald (2006). Implementing a cyclic collection, organization and reporting of that data throughout the research process was intended to help me document mentoring strategies and also to provide an opportunity for faculty mentors to reflect on their practice.

In the second section of this chapter, I will detail three phases of data collection to address the research question of how faculty mentor in the PjBL environment of the

MDM Program. I will discuss how self-regulation became the central phenomenon to investigate in the first pre-research phase and the object of faculty mentoring. Then, I will discuss how the planned research procedures were finalized through the pilot study in phase two. I will then detail the third and main phase of the research, and explain the reasons why the cyclic collection, organization and reporting of data to each participant contributed significantly to the Action Research process. Finally, I describe the final interviews with faculty mentors and students conducted to provide their perspective of the process.

4.1. Part One: Methodological underpinnings

4.1.1. Which Action Research Methodology?

According to Herr and Anderson (2005), "debates rage" (p. 9) between different traditions of Action Research (AR) on its varied goals and underlying assumptions. Action Research can be "group oriented and some individual oriented; some is done by those within the setting and some is done by change agents from outside the organization … some is highly participatory and some is much less so" (p. 9). While exponents of some traditions see the underlying assumption of AR as a desire to improve practice, others are adamant that it transforms "practice and participants" (p. 9). Additionally, many action researchers "advocate [for] a cycle of inquiry involving [variations of] plan-act-observe-reflect" (p. 10), and many agree that models of AR should not be applied "inappropriately beyond the contexts for which they were developed" (p. 10). And, it is important to note that while Lewin (1946), Corey (1949), Freire (1971) and others may advocate for "a cycle of inquiry involving *plan-act-observe-reflect*, this does not mean that their…philosophies are epistemologically, methodologically, or ideologically compatible" (Herr & Anderson, p. 9).

For the purposes of my own research, I drew from three traditions that for me, stood out from the crowd historically. The first tradition integrates a positivist approach

in the early formation and definition of Action Research as a methodology, articulated by Lewin (1940) and evolving into Argyris' Action Science (1980's). Both were used predominantly in work settings. The second tradition consists of a more participatory and cooperative approach to Action Research with far more appeal and wide-range of use in qualitative inquiry. This approach was originally developed by Corey (1949, 1953, 1954) in education, and then evolved with Freire's (1960) influential Participatory Action Research (PAR) in the workplace (McKernan, 1986). PAR is characterized by an emancipatory nature, and is fueled by constructivist and social constructivist theories. The third tradition was inspired by the Teacher-Practitioner movement made popular in Britain by Stenhouse (1970's). This last tradition also appears intermittently throughout Action Research's history in both the positivist and participatory traditions (McKernan, 1986).

4.1.2. Inquiry should propel action

Beyond these varied methodological orientations is the engine that draws researchers of varied epistemological callings to use AR as a methodological framework. The engine is propelled by the possible immediacy of research to inform action. Action Research's alignment with PjBL and other educational environments embraces an older epistemological notion further developed through Pragmatism as demonstrated by Dewey's belief (1941) that inquiry should propel action (Cook & Brown, 1999). Dewey's belief is articulated over the years by other scholars (Schön, 1995; Cook & Brown, 1999; Argyris, 2002; Herr & Anderson 2005, 2014) re-contextualizing Dewey's pragmatic ideas of learning as an "epistemology of practice"— of "knowing-in-action".

Complementary to the primary purpose of identification of mentoring strategies in PjBL, was for faculty mentors to become more aware of the strategies that they used. The cyclic investigation of mentoring was designed to offer MDM faculty mentors the opportunity to reflect on their mentoring. It was my supposition that the action of mentoring, captured, then reflected upon, might influence subsequent strategies that faculty used in future interventions. Discovering what learners needed and reflecting how

they mentored accordingly, could only come through regular interactions. It must be stated, however, that while faculty participants may have changed their mentoring practices as a result of engaging in the Action Research process, it was not within the scope of this research to document change.

The reasoning that action should be propelled by research is one unifying concept that inspired me to stand with McKernan (1986) and other scholars and researchers who emphasize the importance of not "dismiss[ing] whole paradigms and traditions" of Action Research (p. 184) simply because they may have emerged from different contexts and uses. Through McKernan's analysis of the field and his distillation of unifying concepts, knowledge creation, investigative procedures, methods, and how findings are reported, Action Research traditions can contribute diverse understandings of how people learn in the field of PjBL.

4.1.3. Research Purpose and Questions

Inquiry propelling action, was supportive of my integrated research purposes. For me the research had to also fulfill the requirements of a PhD in Educational Technology and Learning Design. For MDM faculty mentors, the research process had to carry with it the intention to deepen their understanding of their teaching practice for the benefit of the learners and on a larger scale, the community of practice that learners would transition into. The integrated research purposes provoked the necessity to ask specific research questions that would broaden our (faculty, staff, learners) understanding of the MDM Program's mentoring practices.

4.1.4. Aligning Cycles of Inquiry with Research Purposes

In preliminary discussions with MDM faculty mentors, the most appealing aspect to implementing an Action Research process was its inherent proclivity to support an investigation with multiple cycles, particularly if these cycles could provide faculty the opportunity to reflect upon their mentoring strategies. The need for cycles of inquiry

resonates with that proposed by Lewin (1946) and established by most Action Research processes since. The cycles consist of “planning, acting, observing and reflecting” (Zuber-Skerritt, 1992 as cited in Masters, 2005, p. 2). Essentially, “reflections of the previous cycle” serve to “inform the plan of the next cycle” (p. 15). Action Research was an ideal methodology to support the inherent nature of mentoring at the MDM Program, as a cyclic process throughout a 13-week project timeline.

The 13-week investigation at the MDM Program consisted of a minimum of three cycles of planning, acting, observing and reflecting for each faculty mentor. The entire 13-week investigation I conducted can also be thought of “as a single loop of problem indication, hypothesizing, acting, observing, and reflecting” (McKernan, p. 190). In a relatively new learning environment like my own (nine years), an Action Research process “is only an initial beginning to serious research” (p. 190). Until Action Research becomes a recurring process in the MDM Program’s PjBL environment, my investigation could still be considered "preliminary action research." (p. 190). It also affirms the need for the continued investigation of our mentoring practices at the MDM Program in upcoming years.

4.1.5. Increasing Awareness of Practice

The drive to investigate mentoring practices reflects another core concept of Action Research. By nature of its implementation, Action Research increases attentiveness towards group practices by drawing awareness (through reflection) to the practices of that community. As I will discuss in Chapter 5, this process led to MDM faculty mentors reporting that they were provoked to think more deeply about their mentoring practices and specifically the mentoring strategies they used.

The reflection that MDM mentors demonstrated aligns with the more emancipatory Participatory Action Research traditions that encourage criticality. McKernan affirms that "self-reflection causes insights and ideas to arise from the examination of practice” (p. 195). MDM faculty mentors were afforded an opportunity to

reflect on the mentoring strategies that they used to mentor learners. Importantly in this initial research study, the decision to change those strategies was left to the faculty mentor.

4.1.6. Relevancy of applying the research to the environment under investigation

My primary research purpose was to more deeply understand how individuals and groups are mentored in the MDM Program's PjBL environments. Supporting a critical lens through which to view our practices then, led me to focus on problems that, common to Action Research, are of immediate concern to a community of practitioners (p. 187). Traditions of Action Research would most likely agree that "the results of research [be] immediately applied to a concrete situation" (Yopo, 1984 as cited in Herr and Anderson, 2005 p. 16). Since its inception, Action Research has attempted to understand the needs and problems of working professionals, not in isolated practice, but in the workplace environment where their dependency on each other to solve specific problems is essential. Thus my decision to conduct my research in the day-to-day working environment of the MDM Program. For MDM faculty mentors versed in professional industry practices and who persistently attempt to bridge anticipated competencies that those industries expect, Action Research provided the path to increase awareness of the mentoring strategies being used.

4.1.7. Collaborative investigative process

The intention to involve MDM faculty mentors as co-participants throughout the investigation is methodologically aligned with the collaborative and participatory nature of Action Research as advocated by Lewin (1940's) and more actively by Corey (1950's). That said, collaborative inquiry in Action Research owes its long lasting legacy and evolution of its emancipatory values to Paulo Freire (1960's). Freire's Participatory Action Research (PAR) and its followers (ex. Yopo, 1984) were "concerned with equity, self-reliance, and oppression problems" (p. 15). The potential for an Action Research

process to be collaborative and emancipatory at the same time, lies in its ability to encourage an “interactive self-critical community of investigators” (p. 188). It was important to establish a collaborative research process at the MDM Program in order to engender trust and communicate the value of conducting research in a community of fellow mentors (Lave & Wenger, 1991).

At the MDM Program there exists a close knowledge-sharing relationship between members of the game industry, faculty, staff and learners. MDM mentoring practices prepare learners for similar mentor-mentee interactions that they will be exposed to after graduating and transitioning into the indie game community. Action Research proposed a process that encouraged participation of both mentor and mentee. It encouraged learners to actively engage in the recording of their sessions with mentors. The process also afforded the community of practicing faculty mentors to comment on the process itself as it emerged. Doing so established mutual respect for each mentor and learner’s knowledge, and for “their ability to understand and address the issues confronting them and their communities” (Brydon-Miller, Greenwood, & Maguire, 2003, p. 14).

4.1.8. Personable process informs methods

Action Research investigations are most responsive using “face-to-face discourse” (McKernan, 1986, p. 194). Capturing and sharing of data is not possible without the “understanding [that] can be achieved only through unconstrained dialogue with participants involved in a project" (p. 194). The more face-to-face dialogue is facilitated and captured, the better the quality of the discussion and the more likely that the knowledge collected reflects the real situation. The qualitative research method I used to capture discussions with each MDM faculty mentor offered a rich source of data as compared to a questionnaire or other format. This is because I wanted the nature of the interview to be more like a conversation with the potential of capturing data that was not anticipated. In addition, as a faculty member in the MDM program myself, trust had already been engendered with all faculty. A simple conversational interview was a

natural extension of relationships that had already been established and afforded a more open and transparent discussion of the mentoring process.

4.1.9. Action Research best supports contextually situated environments

The clearest alignment between Action Research and PjBL environments is in the situated nature upon which both depend. In situated contexts, there is an explicit understanding that research is conducted “in the naturalistic social setting where the problem is encountered and is investigated by those who experience the problem” (p. 189). Aligned with the practice of Action Research in educational settings, McKernan states, that the aim “as opposed to much traditional or fundamental research, is to solve practitioners' immediate and pressing day-to-day problems” (p. 189). Any revelations that are derived from an examination and interpretation of data should be first and foremost useful to the community of practicing mentors. My own situated Action Research process is also concerned with what Freire (1970) referred to as “generative themes, or issues that the community agreed had highest priority” (as cited in Herr & Anderson, 2005, p. 9). As discussed in Chapter 1, these high-priority themes had been previously affirmed by members of the videogame industry in pre-research interviews. The recurring theme of learners taking ownership of the project, was also supported by MDM faculty mentors throughout the primary Action Research phase. As I will discuss further in Chapter 6, the triangulation of pre-research interviews with data from the primary Action Research phase confirmed that all parties were aligned. Mentoring characteristics of self-regulation were deemed high-priority in order to benefit learners interested in transitioning into the video game industry as central participants.

4.1.10. Documenting knowledge

McKernan (1986) asserts that the “degree to which knowledge is shared is the acid test or goodness of fit of [Action Research’s] inherent utility” (p. 193). Producing “solutions and understandings that are useful and that serve practitioners" (p. 193) is a common theme and reiterates one of the epistemological foundations of Pragmatism—of

research serving action. The final public sharing of the research is a document produced with faculty mentors involved in the process, demonstrating inherent member checking and lending further internal and external validity to the value of an Action Research process.

4.1.11. Assertions and generalizations useful to similar environments

In consideration of how outcomes of the investigation will be reported publically, Action Research “recognizes the idiosyncratic and unique features of the actors, problem, and setting” (p. 189). As discussed in Chapter 2, Mayring (2007) refers to any investigation as a process where a researcher needs "to find out what aspects of [their] results are generalizable to what new situations" (p. 6). Unlike positivist research traditions, “key variables are not isolated and rigorously manipulated and controlled” (McKernan, 1986, p. 190). While I cannot “generalize statistically”, I can “generalize logically” (Luker, 2008, p. 44) just as I can build on those logical, naturalistic, generalizations derived from other PjBL environments to support assertions that I build.

4.2. Methods, Interpretation of data and Trustworthiness

There were three phases of research. The first was a pre-research phase where interviews with members of the video game industry were conducted and a pilot study was conducted based on interviews and researcher observations of mentoring sessions conducted by one faculty member at the MDM Program. The second phase was the primary investigation itself. Mentoring sessions with three faculty members and three learner teams were video-recorded. The video recording was played back and then discussed one-on-one with the faculty mentor and researcher. This method known as stimulated recall, can be used as Lyle (2003) suggests as a “microteaching procedure—replaying teaching episodes for subsequent analysis, evaluation and intervention” (p. 874). As Yinger (1986) attests, stimulated recall provides an opportunity for reflection where “subjects report what they are currently thinking and take the opportunity to

elaborate the reasons for their interpretation of the videotape" (p. 271). Stimulated recall sessions with MDM mentors were audio-recorded. These stimulated recall sessions occurred a minimum of three times for each of the three MDM faculty mentors during the course of thirteen weeks. Audio-recorded data was transcribed within a few days of each observation, thematically organized according to the specific mentoring strategies that were observed and discussed during the one-on-one stimulated recall sessions with each faculty mentor. In the third phase of the research, the post action research phase, I conducted final faculty mentor interviews to understand how the Action Research Process supported their mentoring practice. I also conducted learner interviews in order to understand learner perceptions of their interaction with mentors. Figure 6 details the three phases of research.

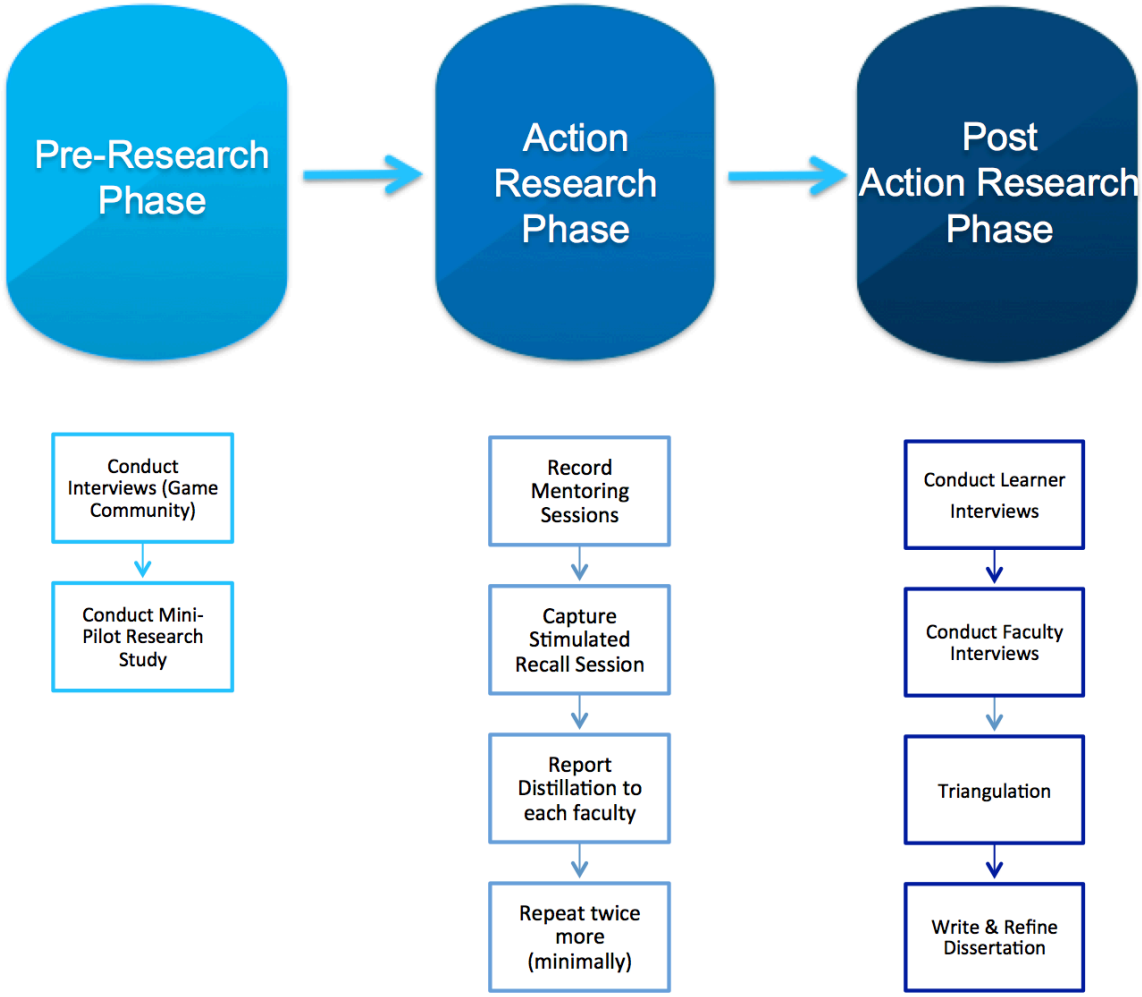

Figure 6: Three phases of research.

4.3. Pre-Research phase: Interviews with members of the video game industry

The motivation to launch an investigation of the mentoring strategies that faculty used was rooted in the interviews conducted with four members of the game industry. The interviews occurred over the course of a year prior to conducting a pilot-study with one MDM faculty member in the fall of 2014.

4.3.1. Process and Findings

An informal open interview method was used with a simple question: What kinds of competencies are you looking for in new recruits? The purpose of the interviews was to help me further clarify the research I wanted to do. The interview data was not formally coded and analyzed. Instead, I created a document listing the types of characteristics mentioned in the interviews. Very interesting to me, industry professionals mentioned characteristics that are consistent with those described in the literature as "self-regulation". While the exact term of self-regulation was never used by the industry professionals, the ability for new game industry recruits to "manage their own learning", "take ownership of the problem", "learn new skills quickly", and "manage themselves and their time" were all considered important.

The interviews motivated me to investigate how faculty mentor self-regulation amidst other competencies through client-driven project courses. As was discussed in my literature review, self-regulation is a common learning outcome of many PjBL environments. Thus, how MDM faculty mentors support self-regulation as a learning outcome of a PjBL process became a logical phenomenon worthy of investigation. While the research literature on self-regulation is abundant, most instruments and typologies have not been derived from PjBL environments and do not focus on the role of the teacher/mentor. To determine how an Action Research process might support an

investigation of our mentoring practices and how it might best be carried out, I launched a pilot study prior to the primary investigation.

4.4. Pre-Research phase part two: Pilot Study

In the pre-research phase, I had the opportunity to pilot Action Research as a supportive methodological framework for the primary investigation. For Herr and Anderson (2014) "piloting [an Action Research study] lets the doctoral student try on research questions and [the methodology itself]; the initial data gathering and analysis can help guide the ongoing direction of the overall research" (p. 71). The pilot study provided an opportunity to develop the methods and processes that I would use in the primary investigation. I also had the occasion to come to a situational definition of mentoring and operationalize self-regulation in the situated context of the MDM Program's PjBL environment. Lastly, I developed an understanding of how the methods that the faculty mentor used could be defined as strategies.

In the next section I will outline the methods used in the pilot study and discuss how findings influenced the methods and processes I implemented in the primary investigation.

4.4.1. Methods

In the pilot study, I observed one faculty mentor six times as he provided mentorship to various teams of learners in a Projects 1 course. I chose this particular mentor as his course was the only one where learners co-constructed digital artifacts together over an extended period of time. I applied the following procedures:

- In each session that I observed, I made my intention known to learners and took typed notes of the kinds of interactions the faculty mentor had with students, at times documenting what he said verbatim;

- Following each session, I re-read and organized the notes according to the types of interactions the mentor used in order to support learner 'ownership' of the project. I labelled these interactions as "strategies". For example, in one instance, a learner asked the mentor how to solve a particular problem. Rather than answering, the mentor asked if there were any tools they had already learned in his class that they could apply to solving the problem. I extracted this text and organized it, along with other similar data in a table. I then searched the literature for this type of method of mentoring before labelling it as a form of "socratic questioning".
- Following each observation, I then met with the mentor in order to show him how I organized the interactions that I collected that he had used to facilitate learner ownership of the project. Commenting on one set of notes the mentor exclaimed, "I said all that?", surprised by the amount of transcribed meeting notes that were documented. At this point we decided together to refer to these interactions as strategies because, as I will discuss later, the interactions were generally intentional and not without an objective in mind. That general intention was facilitating learner ownership of the project.

At the end of the research cycle we reviewed the entire process. The mentor expressed that the process was helpful in drawing awareness to how he approached mentoring the team.

4.4.2. Findings and how they informed the primary investigation

The findings of the pilot study came to inform several aspects of the Action Research process I used in the primary investigation. The pilot study revealed the following: (I list them below and elaborate on each after)

- A situational definition of mentoring;
- The object of mentoring (i.e. What exactly was being mentored);
- The designation of the methods the mentor used, as mentoring strategies;

- The process I would follow in the primary investigation and the benefits of facilitating a self-reflective process.

4.4.3. A Situational Definition of Mentoring

The situated definition of mentoring on projects at the MDM Program that I used drew from my own previous experience mentoring projects at the MDM Program, the research literature of PjBL and mentoring and the findings of the pilot study. How faculty interacted with learners, real-world project interactions, and the notion of productive failure became key in identifying mentoring as the central phenomenon of the investigation.

Defining mentoring in situ

As discussed in Chapter 3, the primary interactions between learners and faculty in the MDM Program are best defined as a mentoring relationship. The definition is reinforced by the fact that MDM mentors have come from and continue to engage in the digital media industry. In addition, because the core curriculum of the MDM Program consists of real-world projects with real clients, mentoring interactions are representative of those in the professional digital media industry.

Learners in the MDM Program do not choose their faculty mentors. This is partly due to the need to align learner skills and faculty experience with the project at hand. Faculty mentors manage the relationship between learners, the client and the design process demanded by the unique problems inherent in each project. There is a tacit expectation from the point of view of the MDM Program, as well as each faculty's reputation in the community, to ensure that a professional relationship is facilitated at all stages of the project's development. For this reason, faculty attend client meetings and debrief those meetings with the teams.

Faculty interactions and ill-structured problems

Faculty mentors interact face-to-face with the team in physical project rooms. The persistent mentoring that occurs places learners in the position of relying on MDM faculty mentors to help them solve domain specific problems. Faculty mentors, who have had previous experience managing projects in professional contexts, manage the learners' co-construction of real-world projects. Often, clients are unsure of what they want as a project outcome. They leave many of the decisions of the design for the learners to propose. Requirements are blurry, resulting in ill-structured problems. As discussed in in the literature review (Chapter 3), faculty facilitate learners to solve the problems on their own.

Productive failure

A defining feature of the mentoring interaction is that faculty support productive failure. When enacted, productive failure affords learners a certain amount of time and effort to make mistakes as they attempt to solve a design problem. Faculty attempt not to intervene. Letting learners solve their own problems is also a key feature of both PjBL environments and self-regulation as discussed in the literature. In the pilot study it became clear that the faculty member acted predominantly as mentor/provocateur to support the development of both individual and team heuristics. He did not solve problems for the learners, but rather encouraged an environment where learners themselves have to iteratively approach solving particular problems on their own. With this approach, faculty as mentors become witness to the learner's articulation of their approach, process and work. They provided feedback for and facilitated the review of each iterative attempt learners made to solve a problem associated with their project.

Based on my own experience as a faculty member in the MDM program and the findings of the pilot study, I became convinced that the positioning that MDM faculty mentors assume echoes those described in the research literature on mentoring. That is,

faculty mentors facilitate an environment whereby learners are expected to rely upon one another to initiate, problem-solve and ‘move’ the state of the project forward.

4.4.4. The object of the mentoring

Similarly, in the pilot study mentoring interactions showed that the mentor’s attention was primarily directed at how learners solved user-centered design problems associated with the project itself, and the collaborative relationship with one another. The mentor supported learners with:

- Questions that mentees had about the design process;
- The application of tools learned in his class that learners were asked to solve design problems with;
- Design-oriented questions such as scope, pipeline, etc.;
- Reflection and/or reaction to the current ‘playable’ state of the prototype;
- Team communication and collaborative issues that may have surfaced as the team solved problems together

Focused in this way, learners were mentored to manage the project and each other. While learners in the pilot study did not have to manage their relationship with a client, in many instances the faculty member represented a proxy client that learners had to respond to. Figure 7 shows the three primary areas that learners were mentored to manage during the pilot study project.

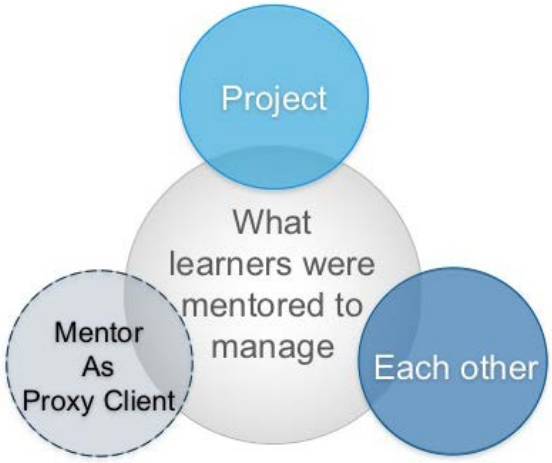

Figure 7: What learners were mentored to manage during the Pilot Study.

Supporting learner 'ownership' of the project

It was in how the mentor interacted with learners where the underlying object of the mentoring was affirmed: to support learner ownership of the project and the design and collaborative problems associated with the project. While the term self-regulation was not used by the mentor, one could argue that learner management of the project, and the process of taking ownership of it are both characteristics of self-regulation. Although the decision to investigate how faculty mentor self-regulation surfaced from the pre-research interviews conducted with members of the video game industry, my preference at this point was not to impose the term to define the object of the mentoring. I was more interested in uncovering the methods that the mentor used to support learner ownership of the project.

4.4.5. Mentoring methods as strategies

What was revealed in the pilot study was that the mentor's methods were generally strategic. While many definitions of the term strategy are drawn from its use in

military contexts, I refer to the more recent use of the term (20th Century) in the field of business management. A scholar of organizational management, Mintzberg (1987) distinguishes between two allied types of strategies. Deliberate strategies, "where intentions that existed previously [are] realized" and emergent strategies "where patterns [develop] in the absence of intentions, or despite them" (p. 13). In the pilot study the methods that the mentor used were generally strategic in that he had an objective in mind. The intended objective of mentoring was to support learner management of the project, each other and the client (primary investigation). The "emergent pattern" (p. 13) was one where the mentor's intentions supported characteristics of learner self-regulation. Because the methods that the faculty member used to mentor were generally strategic and conscious, I was able to distinguish, identify, then categorize them in collaboration with the faculty member.

A typology of mentoring strategies

Through the pilot study I realized that the faculty mentor had his own set of mentoring strategies that he relied upon when mentoring. In his mind there already existed a number of strategies that he drew from depending on his in-the-moment interactions with learners. Each of strategies was named in consultation with the mentor and in reference to the literature, and developed into a mentoring typology. In other words, a system where I could classify the methods that mentors used as types of strategies. Developing a typology was useful, in that I thought it might serve as a launching point for discussion and reflection with the faculty mentors in the primary investigation. I thought that the typology could also be accessed and referred to with each faculty mentor in identifying strategies and then added to if there were strategies identified not on the typology. However, I came to the conclusion that it would be ineffective to provide a typology where each faculty mentor checked off a strategy they had used in their interactions with learners. In other words, it didn't make sense to ask mentors to solely draw from a list of mentoring strategies given the adhoc nature of what

learners needed in-the-moment and because faculty would probably, like the pilot study faculty member, have their own strategies they relied on. Although the typology depicted in Figure 8 (overleaf) would provide a good reference, I decided to approach the task of identifying mentoring strategies anew each time with faculty mentors in situ, and in so doing be open to the discovery of new, unanticipated strategies.

Figure 8: A typology of mentoring strategies developed in the pilot study.

4.4.6. Action Research process and self-reflection

The pilot study confirmed the process and procedures that I applied in the primary investigation. While observing and capturing the mentor's interactions with the learners was important, I also wanted to capture the mentor's reflection on those interactions. Doing so would benefit the faculty mentor who wanted to better understand and reflect on the strategies that he used to mentor learners throughout a project cycle.

Additionally, the pilot study also reaffirmed that the collection of data and its analysis would be intertwined in the primary investigation.

4.5. Action Research Phase

The pilot study, as noted above, allowed me to refine and confirm the cyclic methods of data collection, its analysis and review, and the reporting of that data to each mentor in the primary investigation.

4.5.1. Methods of data collection

Prior to the first observed mentoring session, I met with the three MDM faculty mentor participants in-person and provided a detailed description of the research and methods we would use. I selected these mentors since they were the only ones in the program assigned to projects that initially involved video game development. This made sense as pre-research interviews with members of the video game industry motivated my research. I provided each mentor with an overview of the Action Research process, while setting rules of play for communication and transparency. Faculty mentors were told that they could drop out of the investigation at any point, for whatever reason.

Data collection for the investigation consisted of a three-step process that was repeated a minimum of three times over the course of the semester with each faculty mentor. Firstly, half-hour mentoring sessions were video-recorded. Each session was facilitated by one of the three faculty mentors with a team of five to seven learners. A total of three to four sessions with each faculty mentor was recorded over the course of the semester, beginning the second week of January 2015. A total of 12 separate sessions were recorded.

Secondly, I facilitated a “stimulated recall” session with each faculty mentor after each recorded mentoring session. No initial preparation or discussion with the mentors transpired prior to the stimulated recall session. Sessions consisted of myself and a faculty mentor watching and discussing the video recording of he/she interacting with their learners. Throughout the stimulated recall session, I would pause the video-

recording when I saw what might be a mentoring interaction, and ask the faculty mentor to describe that interaction and the methods that they used. Each of the "stimulated recall" sessions took an average 60 minutes to complete and were recorded (audio only).

Thirdly, each stimulated recall session was transcribed verbatim. Following this, I used the same procedure as in the pilot study. I selected quotes that implicated a particular mentoring strategy. I either categorized it using the typology that developed from the pilot study, or created a new category if a new type of strategy was identified.

Before the next observed mentoring session, I provided faculty mentors with a document based on the stimulated recall session. I did so for them to review how I identified and categorized their interactions with learners as mentoring strategies. I did not give them the entire transcript as they said that they would not have the time to read through a long transcription. Instead what we agreed upon was that I would send them a document reporting how many times each strategy we identified was used and I would also identify new strategies that we may not have discussed in the stimulated recall session, proposing a name for the new strategy. I listed the strategy then provided examples of how the mentor used the strategy supporting their use with a quote from the mentor taken from the stimulated recall session and in some cases from the video-recorded mentoring session. At times I would also provide learner responses from the video-recorded mentoring session to the mentor as either a quote or an observation. This provided further evidence of how they reacted to the strategy.

Throughout the primary investigation I wanted to align the data collection, interpretation of data and its reporting, with the Action Research cycle of planning, acting, observing and reflecting. The initiative supported the fact that the methods of gathering and exploring data were cyclic rather than sequential. Through this cyclical process new data would be transcribed verbatim, distilled and reported back to each faculty mentor in the form of mentoring strategies. The investigation afforded faculty mentors the opportunity to reflect between the time that data was collected, transcribed,

distilled and sent back to them, and the next recorded mentoring session. This allowed faculty mentors the time to reflect on the mentoring strategies that they used, offering them an opportunity to change them or continue their use. This was significant to me, as a MDM faculty member, even though my research did not seek to formally document change, but rather identify mentoring strategies used. The cyclic methods of collecting data are detailed in Figure 9.

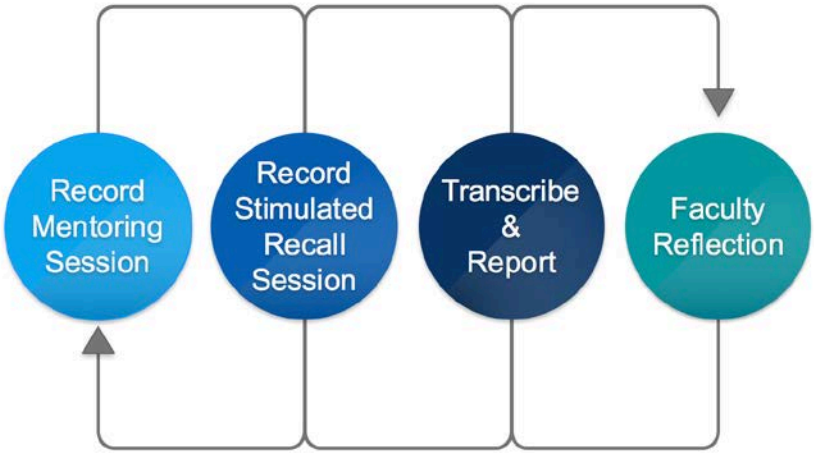

Figure 9: Action Research methods cycle.

The methods of gathering data could be considered as part of the Act, Observe phases of Action Research. The 'Acting' phase was where the actual mentoring that faculty engaged in with learners occurred in a typical pre-planned or adhoc session. The 'Observing' phase corresponded to two stages including the capturing of the mentoring session via video and the subsequent stimulated recall session that captured (in recorded audio) a discussion with each faculty mentor, of the video recorded mentoring session. The examination of data and its reporting back to faculty mentors could be considered as part of the Reflect and Plan phases. The 'Reflecting' phase overlapped, with faculty mentors observing and reflecting on their own mentoring strategies on video during the stimulated recall sessions.

4.6. Post-Action Research Phase

After the Action Research phase, I also conducted individual open interviews with the three faculty mentors and all eighteen learners who had been in the observed mentoring sessions. All interviews were audio-recorded. The faculty interviews lasted approximately 30 minutes and the student interviews approximately 15 minutes. The purpose of the faculty interviews was to address a sub-research question: In what ways did the faculty report that the Action Research Process supported their mentoring practice? The interview began with the question: "How did this research process inform your mentoring practice?" The purpose for conducting the learner interviews was to address another sub-research questions: What were learner perceptions of the faculty's interactions with their teams? Each student interview was open-ended but began with the question "What did you think was the faculty's role on the project?"

4.6.1. Trustworthiness

In Chapter 2, I made the case for warranted assertions (Dewey, 1941) and naturalistic generalizations (Stake, 1983). The truth values generated from generalizations that emerge from research are also dependent on how, as researchers, we communicate the trustworthiness of our research process to the reader. Action researchers do not always embrace the traditions of "naturalistic researchers" (p. 49) and their aim of inferring trustworthiness, since they are also interested "in outcomes that go beyond knowledge generation" (p. 49). To further this reasoning, Herr and Anderson (2014) contend that whether we follow processes of validity from positivists or trustworthiness from naturalistic researchers, "neither term is adequate for action research because neither acknowledges its *action-oriented* outcomes" (p. 49). While action researchers, "like all researchers, are interested in whether knowledge generated from the research is valid or trustworthy" (p. 49), they prefer not to use the criteria of positivists by rejecting "the claims of positivism that the best research is fundamentally about pursuing *truth*

value (internal validity) and by demonstrating that causes and their effects have been isolated" (p. 50). Causes and their effects in this Action Research investigation were impossible to isolate, nor was there a desire to do so. Faculty mentoring could not have been investigated in isolation since the idea of establishing comparable control and experimental groups would be impossible in the setting. The unique strategies that faculty mentors employed were just as dependent on the unique characteristics and behaviors that each team of learners expressed. For my own research process, I aligned with Lincoln and Guba (1985) in seeking other mechanisms to ensure the trustworthiness of any inferences I drew from the data that I collected (Herr & Anderson, 2014, p. 50).

Researcher as insider

Given that I was embedded as a practitioner in the learning environment that I investigated, I positioned myself as an insider subscribing to the conditions of a more participatory and collaborative Action Research approach. More specifically, in reference to Herr and Anderson's "continuum of positionality" (p. 31), I engaged in research activities as an "insider in collaboration with other insiders" (p. 31).

As a result, the research process established trustworthiness early on in the process, embedding itself in the methods of the pilot study and the primary investigation. In the Action Research literature, Baum (1998) claims that "methods should be selected which provide the information necessary to provide an interpretation of the community initiative that will satisfy the needs of the key players" (as cited in Whitelaw, 2003, p. 36). The initial framing of the study around the notion of mentoring and self-regulation came directly from established members of the gaming industry in Vancouver. Also, the cyclic collection of data from the stimulated recall sessions, their transcription and reporting back to the mentor were based on direct feedback from faculty mentors that they wanted a simple way to identify the mentoring strategies that they used, reflect on them, and consider what strategies they used in future interventions.

Transparency

Trustworthiness speaks to the value that research "should aspire towards including a situation of 'transparency' where all participants should be involved in the formulation of a consensus on the nature of the research problem, the choice of methods, subsequent data analysis" (Winter, 1996 as cited in Whitelaw, 2003 p. 16). In the case of the present investigation, transparency was integrated at all stages of the research design. Pre-research interviews with members of the video game industry were prefaced by affirming that the interviews were being conducted in order for me to increase awareness of my own practice of mentoring. I wanted interviewees to know that I was listening and that their needs were being heard. Including pre-research interviews into the investigative process integrated the needs of the community of practice as far as considering what is important to be mentored in learners. As well, one purpose of the pilot study was to determine what the challenges of the research process were for the faculty participant and to incorporate this in revising procedures used in the primary research process. Finally, the research process itself was made transparent for MDM faculty mentors before they began to participate.

Member checking and co-ownership of the research process

Throughout the pilot study and primary investigation, I transformed typical research 'participants' into co-researchers so that each faculty mentor felt that they had co-ownership over the research design. This relationship ensured member checking not so much in the sense of "gaining community approval" but more importantly "recognizing that the process [was] a collective endeavor" (Herr & Anderson, 2014, p. 85).

Persistent member-checking was also embedded in the cyclic method of gathering, analyzing and reporting data to all faculty mentors in-between mentoring interventions. The data collection and reporting cycle was repeated a minimum of three

times for all faculty mentors, and up to five times for some. Faculty mentors were given an opportunity to comment and reflect upon the video-taped mentoring sessions, and my/our summary and interpretation of mentoring strategies. Indeed, member checking satisfies a major theoretical part of Lewin's final three papers on Action Research (1946/1948, 1947a, 1947b) thematically extracted from Bargal (2006). Bargal speaks to the "spiral process" of data collection to "implement goals and assessment of the result of the intervention" (p. 369). Further that Action Research is dependent on the "feedback of the results of intervention to all parties involved in the research" as well as ongoing "cooperation between researchers and practitioners" (p. 369).

Finally, end of semester interviews with each faculty mentor included the question "How could we improve the Action Research process in a future research cycle"? Conducting these interviews was a way to ensure that all faculty mentors had the opportunity to comment and provide feedback on the research process itself.

Mentor/Learner trust-building

While it was communicated to learners involved in the mentoring sessions that a recorded and documented engagement might influence the faculty mentor's perception of their performance, learners were nevertheless appreciative and supportive of the investigation.

Mentors did not try to hide the fact that a mentoring session was being recorded, and at the beginning of every intervention, mentors would announce that the session was being recorded. The response from learners was in-the-moment acknowledgement with a trace of self-reflective humour. "Oh we better speak well" one learner responded. Another with "Hi Patrick, I hope you understand me this time". Still another with "Ok, but no comments on my hair today". After learners were provided an opportunity to acknowledge that the session was being recorded, within 2-3 minutes the camera was

'forgotten'. When asked in an end of semester interview whether they were uncomfortable with the camera, one learner commented "I forgot it was even there. We record everything all the time anyway for ourselves so this was a natural part of that".

Triangulation of data

One way I contended with nurturing credibility was in my decision to triangulate faculty mentoring strategies that were identified with learner perceptions of the faculty's role. I applied Denzin's (1973) qualitative approach to triangulation as "a vehicle for cross validation when two or more distinct methods are found to be congruent and yield comparable data" (p. 302). I also triangulated pre-research interview data collected from members of the game industry with learner interviews in order to determine if learners were 'on-track' to fulfilling some of the criteria that would be expected of them as new recruits transitioning into the video game industry.

Reporting of findings

At all phases of research, I was acutely aware of the potential that "action research, while supporting change and innovation in the workplace, may prove manipulative rather than democratic" (Hart, 1996 as cited in Phelps, 2005, p. 20). Data from my final interviews confirmed that faculty mentors were assured that the investigation was never intended to be a process that the administration of the MDM Program would control "rather than provid[ing] autonomy and opportunity for reflective practice." (p. 20). As an insider conducting research I had no "separate reporting structure and played no active role" (p. 20) in the evaluation of a faculty mentor's performance.

Ethical consideration

Finally, it was clearly stated in the ethics document and repeated throughout the investigation that the recorded sessions would in no way impact the final grades that

faculty mentors gave each learner. In fact, learners benefited from the Action Research process in terms of their final assessment, since faculty mentors were able to witness more directly the overall improvement of each learner over time. They were also able to observe how individual learners had embodied and assimilated specific characteristics of self-regulation that the faculty mentors had mentored. Ethical approval for this study is found on page iii.

In the next chapter, Chapter 5, I discuss the data analysis and triangulation. The research findings are interspersed with this discussion. As the study author, I recognize that this is an unconventional format. Generally, in research theses, the findings are included as a separate chapter from data analysis. But given the cyclical and iterative nature of data collection, interpretation and reporting in the Action Research phase, this seemed like the best way to make both the data analysis and findings meaningful to the reader.

Chapter 5. Data analysis and findings

This chapter is structured in two parts in order describe the data analysis and, triangulation.

Part one of the chapter consists of two sections. In the first section, I will provide examples of the data gathered during the stimulated recall sessions that were reported to each mentor in-between mentoring sessions, as discussed in Chapter 4. In the second section of part one, I discuss the analysis of the faculty mentor interviews.

Part two of the chapter also consists of two sections. In the first section, I will detail how I re-organized data gathered from all nine stimulated recall sessions. In the second section of part two I will describe how I triangulated the data collected from the nine mentoring sessions and nine stimulated recall sessions, with final learner interviews. I did so in order to understand the relationship between what the faculty mentored and characteristics of mentoring that learners may have perceived.

5.1. Analyzing and reporting data from the stimulated recall sessions

As discussed in Chapter 4, audio-recorded stimulated recall sessions were held with each faculty mentor following each video-taped mentoring session. Recall sessions consisted of myself and a faculty mentor watching and discussing the video recording of them interacting with their learners. Throughout the stimulated recall session, I would pause the video-recording when I saw what might be a mentoring interaction, and ask the faculty mentor to describe that interaction and the methods that they used. I then created a document that organized and labelled each of the mentoring strategies. I described the mentoring interaction, provided quotes from the stimulated recall session as well as quotes and observations from the video-recorded mentoring session. This document was

sent to the faculty mentor. While no further formal discussion was documented, mentors had the document to refer to in subsequent mentoring sessions. The analysis and reporting of the data as mentoring strategies drawn from the stimulated recall sessions occurred three times for each faculty mentor for a total of nine reported documents.

The language and tone that I used in reporting the mentoring strategies back to the faculty mentor was brief. The structure of reporting each strategy consisted of:

- identifying and elaborating the strategy;
- providing examples of how the strategy was used from the observed video-recorded mentoring session;
- including the faculty mentor's response to the mentoring strategy that they used as recorded in the stimulated recall session.

As I prepared these documents, certain categories of strategies began to emerge; one such category was Socratic questioning. For example, in several instances I positioned the use of silence as a strategy under the category of Socratic questioning. An elaboration of the strategy was then provided. In this case, the mentor would pose a question and then wait for learners to speak and engage in conversations with one another. I then presented an excerpt from the recorded session with learners as evidence. In the example of silence as a characteristic of Socratic questioning, the faculty mentor asserted to learners that "the next thing you're going to need to understand is his [referring to the client] language" (mentor 1). The faculty mentor then asked the question: "Is he [client] wanting a prototype?" (mentor 1), which was followed by silence as the faculty mentor anticipated a learner to respond. The observed response from learners was then communicated to the faculty mentor. "One learner jumped in and asked the next question and you allowed the conversation to carry on without intervening, eventually inspiring another" (interviewer). In some cases, I would also include the faculty mentor's elaboration of the strategy communicated to me during the stimulated recall session. For example, after commenting to the faculty mentor that they had allowed 'space' in the

conversation for learners to respond, the faculty mentor responded that "[learners] also need to start answering these things for themselves" (mentor 1). In the faculty interviews, all faculty mentors mentioned that receiving these reports of the stimulated recall sessions that pointed out the strategies they had used and how they were categorized, supported their own reflection and review process. See Appendix C for an example of two of these report documents. I return to a description of the strategies identified in section 5.1.2, but first I describe faculty responses to the interview questions in which they described their perspectives on the action research process.

5.1.1. Triangulation with post Action Research mentor interviews

The immediacy of providing mentors with a document of the mentoring strategies they had used in a mentoring session with learners was intended to support them in reflecting on their practice. In order to understand if indeed, the reflection cycle of mentoring interventions was useful and if so how, I conducted interviews with all faculty mentors at the end of the action research investigation. The interviews revealed insights, as discussed below, as to the importance of the process for each individual, and in particular the usefulness of the overall approach of focusing on mentoring strategies that each faculty mentor used. After transcribing the interviews verbatim, I extracted only those quotes that made direct reference to how the Action Research process benefited them. I then categorized them according to themes that emerged from the data. The first theme implicated how the Action Research process supported reflection and that the practice of review was aligned with the retrospectives that each mentor facilitated with their teams. The second theme revealed that there was some usefulness of documenting their mentoring strategies so that they could draw from them. The last theme revealed that the mentor's perception was that the focus of the mentoring sessions centered on managing the client.

Reflection and Review

In terms of reviewing and reflecting on their mentoring, one faculty mentor commented in a final research interview that they "found it eye opening…it was really helpful, it was nice to review. I haven't had the opportunity to see, rewind and confirm notions I might have had ... overall very worthwhile" (mentor 2).

Another faculty mentor commented that the process "would incite me to think":

> I wonder what I could do differently. I should get more feedback with the rest of the faculty. Here are the other tools I could use'. It led me down to that question. 'I wonder what else I could do?' I have my own toolbox but then the whole process has elicited me wondering how do I expand my toolbox (mentor 3).

This last reflection was common for all faculty mentors. The stimulated recall sessions were conducted one-on-one, and faculty mentors clearly mentioned that moving forward, they would like to know and reflect upon the strategies that other faculty mentors were using as well. The reason for this was expressed in a different way by another mentor who insisted "I know what works for me but maybe my vocabulary of tools leads to the same results" (mentor 1). The reflection on their mentoring surfaced a common need to question the strategies that they used. Perhaps not for the specific purposes of improving their strategic approach, but moreso in experimenting with new strategies to see if different results could be observed.

The reflection that the stimulated recall sessions afforded were also felt to be complementary to the reflective mentoring sessions that each mentor facilitated with their student teams. Each recorded video session was a reflection of learner interactions with the client. Additionally, at the end of the project cycle each mentor conducted a retrospective with their teams, which provoked reflection on the entire project process. This was a way for learners to address their performance, that of the team's and reflect on their interactions with the client.

One mentor challenged learners to reflect on the reasons why a team would conduct a retrospective in the first place. The mentor asked the team: "Why do you think project teams would do post-mortems" (mentor 2)? The variety of answers are worthy of quoting here:

> Learner 1: You have to analyze what you did correctly and those things you did not do so well so that in the future you can do better;
>
> Learner 2: I would say different perspectives. You may think something went well but not be aware of other things so overall as a team, it helps you as a professional for the future as a team but also as a team to really know what happened;
>
> Learner 3: Being more efficient, like if it's the same thing you're going to keep working on then it's more efficient and hopefully you are learning;
>
> Learner 4: If you were a company you have to analyze some of the procedures that you're using as a company. If they are working or if it's just taking time off of from keeping productivity going.

The documented reflection that formed part of the Action Research process for faculty, also inspired mentors to talk of the benefits of regular reflection with their teams. As one mentor stated: "Regular reflection and its documentation is a discipline kind of thing, like exercising. Not everyone likes to do it. Not everyone likes it, but once you get into the habit, it becomes easier and the benefits outweigh the work involved" (mentor 2). In their final retrospective with their team, the same mentor also proposed its long-term benefit as a best practice within the video game industry.

> You can use it to monitor how much time you are spending in your day, to predict, like when someone asks you to estimate you have a record of how long it actually takes. If you were to do a performance review and your manager says so what did you do these past three months. I did this, and this and did this 'cause here it is in my daily log. Oh yeah you were the one who had that breakthrough. And no one remembers now but it was you, so maybe your contribution can be recognized (mentor 2).

In-the-moment reliance on previously used strategies

While all faculty mentors conceded to "going with the flow" (mentor 3) or "dealing with stuff as it came up" (mentor 1), all mentioned that accessing previously used strategies was beneficial. One faculty mentor mentioned that "it was nice to know I could use them if I wanted to" (mentor 1). Even though faculty mentors had a strategic intention to facilitate learner ownership of the project every time they walked into the mentoring session, how they did so sometimes changed in-the-moment depending on the learner responses that the strategy provoked.

> Sure there are strategies because I do come in with these meetings specifically with goals in mind. I'm going to ask these questions. It remains conversational because that's what I prefer but you go in with those specific questions in mind and you try to smooth it in as if it was a natural part of the conversation (mentor 3).

In this case the pre-planned strategy was to indirectly provoke discourse about how the project was proceeding but it was guised in a way to make it seem informal and unplanned.

Even though faculty mentors did not specifically express that the investigation helped them to apply strategies that targeted self-regulation, having access to a growing list of mentor strategies they had used was beneficial to support learner ownership of the project.

Managing client expectations

A persistent theme with all mentors was that reflection on their mentoring practice brought to the surface the crucial role they had in supporting learner management of the client relationship and client's expectations. This is because, as one mentor claimed due to the lack of experience learners had in managing clients. "When they haven't dealt with a client ever before, it's so new and foreign that everything the client says can be huge" (mentor 1). The same mentor attested that a recurring role was for them to remind the

team that managing the client's expectations meant always being attentive to what the client was saying. "The client has said this multiple times. Multiple times. You have to listen. (*laughter*). It cannot be any more clear. Really? Yes. It's just listening. The client said this 3 times. They're clear about what they want and don't want" (mentor 1).

Similarly, another mentor mentioned that the stimulated recall sessions revealed an increased attention to how much focus was placed on managing the client. They felt that their primary mentoring role was to ensure the team was aligned with what the client wanted. They seem to "get stuck again and again in their own ideas before trying to bring in the client's buy-in to the process. As a team we can't jump the gun and get really invested in our own ideas before we get the client in the room and turn our ears off" (mentor 2).

Two of three mentors repeatedly mentioned the importance of using the same language the client did. One mentor explained the problem. "They (the team) learn through their first semester projects, a certain language. And they have to re-learn words the client uses" (mentor 1). The solution seemed to be similar with all mentors. As one mentor stated: "I attached myself to the words the client used. Then I have to drill it into the student team. We are calling it these things. And we keep drilling it until they get it" (mentor 3).

5.1.2. Documentation of Mentoring Strategies

Organizing a document that provided the faculty mentor with a list of the mentoring strategies they used, was a process primarily serving the needs of the mentors. There was not much time for me in between mentoring sessions, as researcher, to re-interpret the data and reflect upon its further meaning, nor to compare strategies across all three mentors. The most I was able to achieve was to document a growing list of strategies for each faculty mentor. On initial review, the strategies used by faculty mentors seemed to be spontaneously drawn in-the-moment, and dependent on the needs of the learners. The development of a list of mentoring strategies unique to each faculty

mentor, however, did benefit the mentors as they could review the types of strategies they had used over time and some claimed their re-use. In this way, even though mentors adapted the strategies they used based on interactions with learners, they also drew upon previously used strategies.

At the completion of the entire research cycle I felt it would be beneficial to assemble all the mentoring strategies together with nine separate documents of mentoring strategies to draw from. Doing so allowed me the opportunity to revisit the "data for a more thorough, holistic understanding" (Herr & Anderson, 2014, p. 84) with less pressure to report the data quickly. This process is aligned with Herr and Anderson who claim that "the data and analysis have more to offer than what one has … the chance to thoroughly explore" (p. 84).

Figure 10 shows the process that I went through in re-organizing the mentoring strategies from all three faculty mentors.

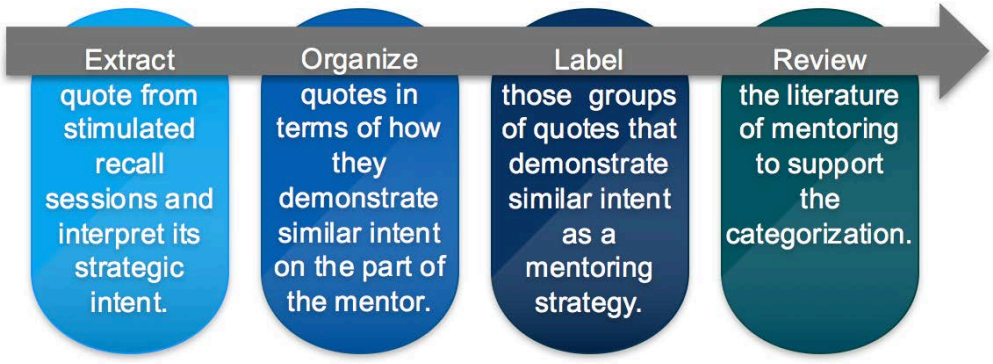

Figure 10: Process used to reorganize mentoring strategies drawn from nine stimulated recall sessions.

Quotes were extracted from the recorded video sessions in addition to the audio recorded stimulated recall sessions with the three faculty mentors. The quotes were organized according to their strategic intent and categories were formed and initially named. I then relied on the literature of mentoring in order to refine my interpretation of

the categories that I had labelled. I looked for precedence in the strategic use of particular approaches to mentoring in the self-regulation literature. While many of the mentoring strategies were categorized based on a singular strategic intent, others implied more than one strategy that was used simultaneously. Lastly, not all faculty mentors used all the different types of strategies shown in the typology. I've decided to only include those strategies that occurred in more than one mentoring session. The extracted quotes and their grouping are illustrated in Appendix D. In following the process outlined in Figure 10, I was able to create a typology of most commonly used mentoring strategies as demonstrated by all three faculty mentors.

Part Two: Re-coding and triangulating the data

5.1.3. Re-organizing the identified mentoring strategies

Re-organizing the mentoring strategies I had documented from the nine stimulated recall sessions resulted in 12 categories of strategies (see Figure 11).

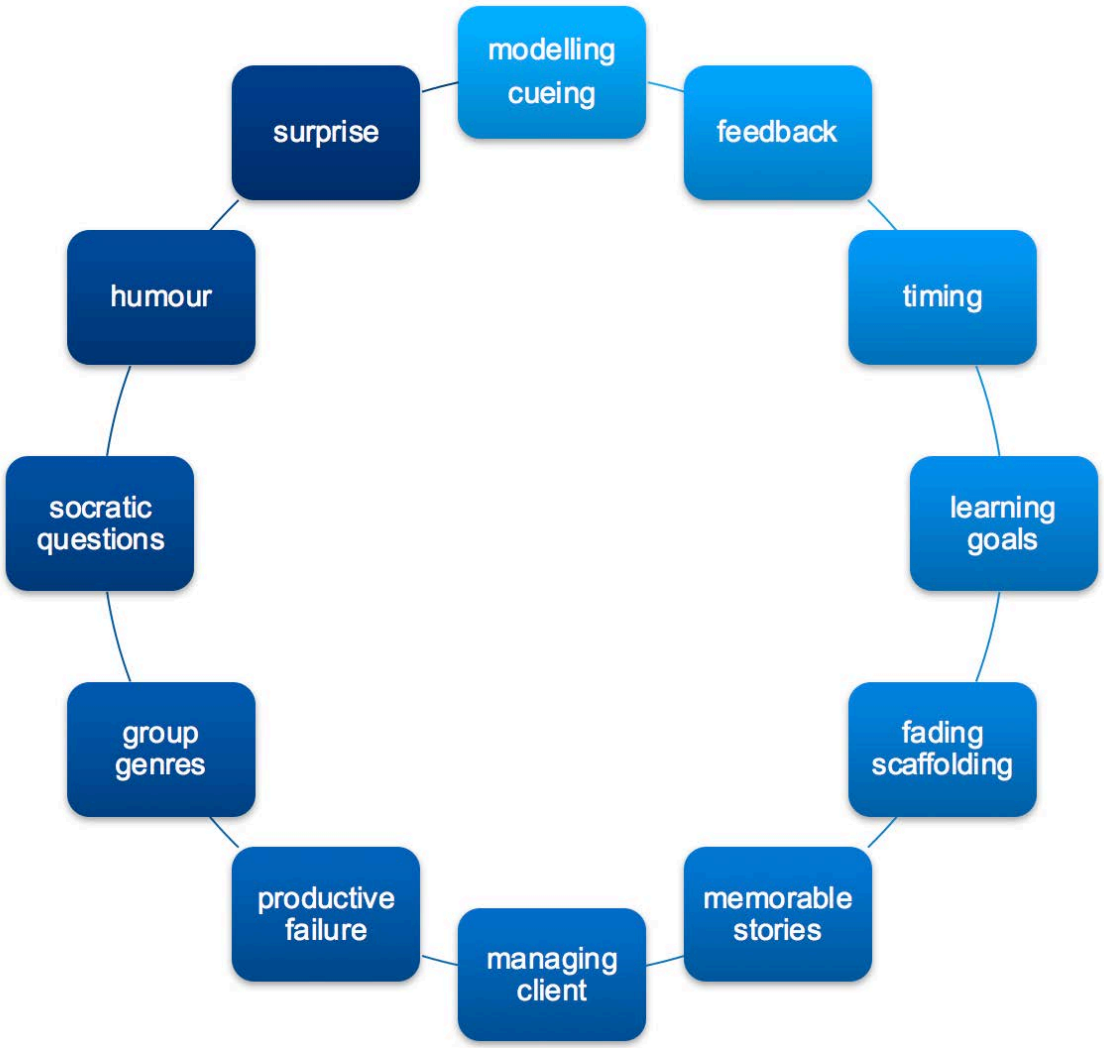

Figure 11: Typology of mentoring strategies from nine stimulated recall sessions.

Table 1 provides a sample of how the strategies used in the nine mentoring sessions were re-organized. Initial grouping, categorization and interpretation of 60 extracted quotes are illustrated in Appendix D. In column one of Table 1, I show

extracted quotes from the stimulated recall sessions with faculty mentors. The second column consists of faculty mentor quotes or observations drawn from the video-recorded mentoring sessions. Each quote implies strategic intent and represents an example of a more extensive grouping in Appendix D. In column three I show my interpretation of each quote in terms of its strategic intent. Finally, column four shows how I categorized each mentoring strategy. Each category type in column four is discussed below with reference to the literature.

Table 1: Mentoring strategies identified, interpreted and categorized

Quote from stimulated recall session	**Quote or Observation from video recorded mentoring session**	**Interpreted Mentoring Strategy**	**Category**
"I was cueing them to slow down in their presentation. Then they did it for themselves" (mentor 1).	Faculty mentors cueing learners to slow down their speaking during the presentation. Learners then imitating this approach.	In-the-moment feedback which learners picked up on and used with each other in the same and subsequent meetings with the client.	Modelling
	"The scope of your pitches were too big. He did not hear the core idea" (mentor 1).	Provided feedback on specific situations and guided learners as to how to they could improve.	Feedback
"The important thing was catching it immediately after the moment because they're still doing a personal reflection" (mentor 1).		This is in reference to the timing of the debrief to immediately follow the team's interaction with the client.	Timing of the mentoring
"All I ask is one question. What does good like at the end of the term? They usually tell me from a team perspective and an individual perspective" (mentor 3).		Facilitated by faculty mentors at the beginning of each project.	Setting learning outcomes
"Everything going forward is just replacing and iterating which they already have a rhythm for" (mentor 3).	The duration of the mentoring session decreasing over time.	Less offers of guidance proposed to learners because they are solving their own project challenges and managing each other and the project.	Fading and Scaffolding

Quote from stimulated recall session	Quote or Observation from video recorded mentoring session	Interpreted Mentoring Strategy	Category
	"The next thing you're going to need to understand is his language. "Is he wanting a prototype" (mentor 1)?	Waiting for learner response as a strategy to facilitate them having conversations with one another.	Socratic prompting and use of Silence
1. "We actually start with what went well, what didn't work, what do we need to change" (mentor 2). 2. Faculty mentor refers to a whiteboard drawing of what learners said at the meeting (mentor 1).		1. Drawing from a tool learned in their previous semester (KFC). 2. Graphic recording a meeting to facilitate meeting debrief.	Reliance on previously learned group genres
"I've never been on a project where I stopped thinking about it because it was Friday afternoon and I've got to do this other thing on Saturday" (mentor 1).	A memorable story of a professional approach to working is recounted by the faculty mentor to impress that the project was always top-of-mind.	Sharing a previous and relevant experience with the team.	Memorable Stories
	"Keep it simple. Think about your childhood experiences" (mentor 1).	Reminding team about the client's explicitly stated aesthetic.	Targeted tools to manage client expectations
"I think that also in order for them to improve they have to have something to contrast it. So they know this was a bad meeting. Maybe that will stimulate them in their next meeting to be more on the ball. Failure is a learning opportunity" (mentor 2).		Faculty mentors allow learners to 'fail' or at least to make mistakes in-the-moment without intervening.	Productive Failure
"I do it in this format rather than giving them anything ahead of time. Or even when they ask so what's the purpose of this 360. I keep it very vague until I'm there because I tend to prefer answers that haven't necessarily been rehearsed in their mind previously" (mentor 3).		Faculty mentors placing learners on the spot during several sessions.	The Strategy of surprise

Quote from stimulated recall session	Quote or Observation from video recorded mentoring session	Interpreted Mentoring Strategy	Category
"I teased her about it and joked with her and they got to laughing eventually" (mentor 1).		Humour as a strategy to soften intense self-criticism that learners go through.	Humour

Modelling

Besides goal-setting, a common mentoring strategy in the research literature is modelling. As Johnson (2005) argues, modelling "allows direct demonstration of many behaviors specific to the profession, and this often produces faster learning than direct experience" (p. 93).

Modelling self-regulatory behaviors was common with all MDM faculty mentors. These were observed particularly through faculty mentor interactions with the client at meetings. Most notable was one faculty mentor's modelling of non-verbal cueing during one of the client meetings. In their words, "I was cueing them to slow down in their presentation" (mentor 1). In this case the team was in the middle of a meeting with a remote client (via Skype voice) and the situation demanded that the faculty mentor cue a particular learner to slow down, which gave the rest of the team permission to engage in similar non-verbal cues with one another such as pointing, writing on a whiteboard, signaling, and whispering between team members, etc. The learners picked up on the mentor's non-verbal communication and immediately applied the strategy by cueing each other.

Johnson (2005) also writes of "appropriate self-disclosure—particularly in relation to [a mentor's] shortcomings—as a way of offering protégés a model for coping with imperfection" (p. 94). At the MDM Program, that imperfection was often described as a failed moment in a faculty mentor's own professional experience. Failed moments were recounted through some kind of 'war' story— a story that emerged in the moment depending on the problem learners were trying to solve. In these cases, MDM faculty

mentors told war stories in order to model what not to do. They usually surfaced as a warning of the potential consequences of a particular course of action that learners were considering taking in their existing projects. Evidence of a cautionary tale surfaced when one project team's client's company was shut down in the middle of the semester and the learners were understandably upset and disappointed. The faculty mentor reflected on his own previous professional experience. "We were in the middle of finishing some projects when about 3 of us were told that my division of 75 people would be closed. So we had about 8 weeks of finishing work before we knew we were toast" (mentor 1). Besides highlighting the reality of a rapidly changing and economically unstable gaming industry the faculty mentor also reflected on what not to do when faced with the reality of these kinds of situations.

> You'd be sadly mistaken to jump onto Facebook or wherever else and be like 'oh my god we just got dumped and our client's gone. What are we going to do at the MDM now? That sucks'. You're torching more than just yourself and you're also hurting your own reputation in the industry because people rely on your confidence (mentor 1).

Feedback

Throughout the observed mentoring sessions, the feedback provided by MDM faculty mentors manifested in a variety of ways and for different purposes. Faculty mentors provided feedback on how the team of learners as a whole interacted with the client. For example, some feedback consisted of how learners could improve "scoping" a project; projecting the amount of anticipated work it might take to realize a client's vision. In another example, mentors challenged learners' understanding of the "core idea" (the central idea that solved the design problem) of their project, and provided feedback on how well they thought the learners understood what problem the project would solve. Strategically, faculty mentors tested learners with challenging questions in order to anticipate how the client might respond to their next round of ideas and prototypes. Feedback was directed to the team and individuals on the team during the recorded mentoring sessions.

Repeating and reframing feedback was a necessary strategy, not solely incorporated by the faculty mentor. This was evidenced by a learner asserting on one of the recorded sessions that "after he [referring to the client] explained for the third time I got it" (learner 6). While the importance of repetition of feedback was palpable, what is evident is that learners needed to hear the same feedback in a variety of contexts and from a variety of sources (not just the faculty mentor) in order for them to assimilate the feedback as a lesson-learned. The faculty mentor further elaborated that it was an "indicator that [the learner] had to hear it three times from the client before [they] decided that it was an important task" (mentor 1).

In another context the faculty mentor needed to 'translate' client feedback or re-articulate the same feedback in another way. The impulse was believed necessary in order for learners to really "get it". This was evidenced in the recorded mentoring session when learners were unable to understand that the client sought better quality character designs before approving them for integration within the game. In this instance, the faculty mentor reframed the feedback as the client's need to have "higher fidelity prototypes of their character design" (mentor 1) prior to giving the team approval to "put them in the game" (mentor 1). As the faculty mentor asserted "students are much more conscious of the short term and that was how to bring the idea into a context they could relate to more easily" (mentor 1).

Working on projects with real clients afforded learners one of the defining features of self-regulatory behavior— a self-reflective feedback loop (Zimmerman, 1990). For Zimmerman, the loop

> entails a cyclic process in which students monitor the effectiveness of their learning methods or strategies and react to this feedback in a variety of ways, ranging from covert changes in self-perception to overt changes in behavior such as altering the use of a learning strategy (p. 5).

Of the many interactions with clients, learners were persistently challenged by faculty mentors to modify their behavior towards one another and the client. They often received direct feedback from clients based on the presentation of their ideas or pitches, and how they conducted communication remotely and in-person with them. The post-client meeting debrief sessions afforded learners multiple opportunities to "get it right" even if it involved a repetition of the same feedback they might have received earlier, or by another stakeholder in the project. In the case of one team who resisted earlier advice from a faculty mentor to document their collaborative design process in a daily log, the faculty mentor provided the reasoning for just such a task.

> Recognize that this insight is for you in the future so that if you recognize a similar thing happening on another project whatever it is, next year, next month, two years from now that you can recognize that this is happening and you need to to do something about it (mentor 2).

Timing of the recorded mentoring session

From a discussion with one faculty mentor at the beginning of the investigation, we determined that post-client debrief sessions would afford the richest source of data collection. Post-client debrief sessions provided varied interactions with learners that could be captured and reflected upon. In addition, the immediacy of conducting mentoring sessions directly after a client meeting was seen as crucial. As a faculty mentor exclaimed:

> The important thing was catching it immediately after the moment because they're still doing a personal reflection. Because they are really wondering how they did or whether or not something they did, didn't happen, or whether they should be cheering that their idea or their comment in the meeting was the one that won the day (mentor 1).

The timing of mentoring interventions is discussed in the literature but there is not much systematic research that I could find, addressing its practice in PjBL environments. Often, faculty mentors strategized surprise visits or if pre-planned, learners didn't always know what to expect. This strategy also prepared learners for the unexpected. As one

industry professional affirmed in a pre-research interview “we need people who are ok with not knowing what to expect and who can act quickly when things change because the video game industry is like that” (interviewee 1).

Learning goals

Each faculty mentor worked with individual learners at the beginning of the semester to set learning goals. One faculty mentor insisted on asking each individual team member “What does ‘good’ look like at the end of the project” (mentor 3)? The question was asked of learners in both one-on-one sessions as well as in a group mentoring situation. The faculty mentor went on to observe that

> they usually tell me from a team perspective and an individual perspective. And I keep that in mind to see if they are more or less aligned. And if they’re all over the place that’s fine because there’s still plenty of time to align them, but also to see what their goals are … gives me a clue (mentor 3).

The literature of mentoring and self-regulation both speak to the importance of goal setting and numerous papers show that self-regulating learners improve academically when they set goals. Zimmerman (1990) attests that “self-regulated learners are not merely reactive to their learning outcomes; rather, they proactively seek out opportunities to learn” (p. 6). Additionally, a spirit of “heightened motivation is evident in their continuing tendency to set higher learning goals for themselves when they achieve earlier goals” (Zimmerman, 1990, p. 6). MDM faculty mentors work with learners to set goals and then strategically revisit them throughout the semester. Learning goals are referenced when faculty mentors facilitate peer reviews in the middle of the semester.

Faculty mentors periodically tested what learners had learned depending on the role they had taken on in the project. In doing so, new learning goals surfaced. For example, one faculty mentor challenged a learner to reflect on the skills required of a game designer after the client “felt compelled to tell them that he did have an issue with

their prototype and he cited that their core mechanic did not make the game addictive" (mentor 1). The client "could see the player playing the game only once" (mentor 1) so the faculty mentor challenged the learner-as-game-designer to develop the potential re-playability of the game. Not only was the design element an important feature of most well designed games, the ability to achieve re-playability is characteristic of a good game designer. This example also demonstrates that client-learner interactions afforded faculty mentors multiple opportunities to challenge learners to refine their learning goals. Many of those refinements were in alignment with typical challenges they would meet in the community of practice they wanted to transition into.

Another faculty mentor emphasized the importance of learners self-tracking what they learned and specifically, how they solved problems throughout a project semester. Not only would they accelerate their understanding of solving design problems but their efforts to document could also be rewarded.

> If you were to do a performance review and your manager says 'So what did you do these past three months?' 'I did this, and this and did this cause here it is in my daily log.' 'Oh yeah you were the one who had that breakthrough'. And no one remembers now but it was you, so maybe your contribution can be recognized (mentor 2).

Fading and scaffolding

From a cognitive, social constructivist and situated learning perspective fading is part of a process that "involves gradually reducing coaching as students internalize" what is being taught (Wood et al. as cited in Hickey & Anderson, 2007, p. 188). Azevedo and Hadwin (2005) suggest that "scaffolding involves providing assistance to students on an as-needed basis, fading the assistance as learner competence increases" (p. 368). In the literature there seems to be a prevalent assumption that when scaffolding fades over time, self-regulation increases. Zimmerman and Tsikalas (2005) claim that "in contrast to social cognitive emphases on fading of social support … cognition and metacognition are fundamentally social processes and learners become self-regulated by learning to operate

effectively within social contexts" (White & Fredericksen, 2002 as cited in Zimmerman & Tsikalas, 2005, p. 271). Moreover, they argue that "by understanding and successfully enacting different roles in project groups, students learn to identify, organize, and deploy their own self-competencies" (p. 271).

Generally, MDM faculty mentors attempted to decrease the duration and lengthen the periodicity of the mentoring interventions that they facilitated with learners over time. However, the fading was not consistent for all faculty mentors. Two of the three student teams required daily mentoring for the first three weeks. These sessions were followed by facilitated sessions once or twice a week, usually corresponding to post-client meetings. On the other hand, the third student team only required mentoring sessions once a week.

What is more representative from the data is that the unexpected and ill-structured nature of the MDM Program's PjBL environment, posed challenges to any notion of consistent and pervasive fading across time and between teams. Exceptions are inherent in any PjBL environment. While fading occurred gradually over time with two of the teams, nine weeks into one project, a team lost a client with the closing of a game studio, and suddenly the faculty mentor was forced to increase the amount of mentoring. This meant that the faculty mentor had to 'ramp up' the mentoring for a two-week period in order to support learners and empower them towards continuing the project on their own. While the increase of mentoring contradicted a 'natural' progression to fade, the intervention, according to learner interviews, contributed to greater self-determination and self-reliance from some members of the team. I will discuss this situation again when it comes to the strategy of productive failure, which is an inherent component of many project courses.

In contrast, another faculty mentor expressed that "everything going forward is just replacing and iterating, which they already have a rhythm for" (mentor 3). On this particular project team, the faculty mentor observed that learners were maintaining a productive rhythm that emerged early on in the development of the project. The team's

demonstrated self-reliance afforded the faculty mentor the opportunity to fade, reducing the recurrence of their mentoring sessions to once a week by the eighth week. The rhythm in this case described the team's ability to be self-governing, and self-managing.

Socratic questioning, silence and focused listening

Learners at the MDM Program were often incited to solve their problem(s) through Socratic questions initiated by faculty mentors in order to provoke a reflexive environment. Rather than "providing direct answers" or directives to learners, faculty mentors applied "Socratic questioning in order to stimulate student's minds by continually probing into the subject with thought-stimulating questions" (Paul as cited in Yang, Newby, & Bill, 2005, p. 164). In turn Socratic questioning stimulates critical thinking (p. 164). Below is an example of the type of Socratic questioning that one faculty mentor regularly used with their team.

> Mentor 2: How do you think the meeting went? [with the client]
>
> Learner 1: It was disorganized
>
> Mentor 1 on tape: So why was it disorganized? You knew the meeting was today at ten.
>
> (pause)
>
> Learner 2: We were unprepared …
>
> Other learners (3,4,5): Yeah! Yup! Ya

The faculty mentor did not tell them what he thought the problem was, but rather provoked them through open questioning to identify the problem. While some questions could be considered leading questions, there were other questions that were more like recall questions, requiring learners to pause and take a moment to reflect on the client meeting they had just had. Other recall questions challenged learners to remember a tool or process exercised earlier in the semester that would help them solve the problem at hand.

Socratic questioning was a common strategy used by all faculty mentors to support characteristics of self-regulatory behavior, such as critical thinking and self-reflection. In the previous example, the primary purpose was for learners to be able to identify their own lack of preparation through reflection. The secondary purpose was a concerted attempt by the faculty mentor to guide the team towards a deeper understanding of why the meeting did not go so well. In this way the faculty mentor guided them to the root of the problem so that in future meetings they could demonstrate ownership of their project by "taking command" (mentor 2) of the meeting and "getting what you [learners] want" (mentor 2) from it.

Another aspect of Socratic questioning that mentors demonstrated, was to pose a question that was difficult to answer, and to simply wait in silence for learners to answer. This was revealed earlier when one mentor stated "the next thing you're going to need to understand is his language. Is he wanting a prototype" (mentor 1)?, followed by a long silence as they waited for learners to respond. On the video-recording, it appeared that one learner jumped in and asked the next question and [mentor 1] left enough space for someone else on the team to respond. This prevalent type of prompting challenged learners to 'fill-in-the-blanks'. It also propelled them to carry on the discussion without the need for the faculty mentor to join in the discussion.

Still another strategy used was to go beyond the immediate circumstances of what happened in a client interaction in order to challenge learners to understand how and why the interaction transpired as it did.

> What I'm trying to get out of them is how did they conduct the meeting? Were they effective in getting in their communications? Did they? Were they able to either receive what they were looking for, solicit or push the meeting enough to get what they needed out of the meeting (mentor 2)?

Demonstrated here is the faculty mentor's intention to challenge learners to ensure that they "get what they need out of the meeting" (mentor 2). In addition, the faculty mentor proposes that learners need to take ownership of the meeting.

In terms of strategic listening, one faculty mentor exclaimed "I like to have them talk first before I provide my thoughts. Then in that case, I can immediately reinforce any thoughts they had which boosts their morale or 'I'm on the right track type of thing'" (mentor 3). At the same time as providing positive feedback the faculty mentor also provided learners the opportunity to be heard. In hearing themselves talk, learners could understand "where they were at" (mentor 3) and the faculty mentor affirmed if this was the case. While a seemingly simplistic strategy, the importance of listening was essential as learners had

> all these thoughts going on constantly in their heads and they need to vent them out … otherwise they keep spinning in there. As soon as they talk, verbalize it, and it's rare that someone wants to verbalize out loud to themselves. They just want someone to listen and as soon as someone listens: 'Hey I'm gonna do that now' (mentor 3).

The opportunity that was offered for learners to openly express themselves in a focused session afforded them the capacity to listen to how they articulated their own understanding of the state of the project, their role and that of others on the team.

Upon observation, the final three recorded mentoring sessions compared to initial mentoring sessions were distinguished by an increase in learners talking and an overall decrease in the faculty mentors speaking.

Reliance on previously used group genres

Some faculty mentors frequently referred to and at times facilitated the use of specific tools they had taught learners in previous semester classes. These tools are described in Appendix A, and B. Examples of some of the tools learners were expected to

draw from, included a Persona map which represented a potential product user's psychographic profile, a Day in the Life storyboard that projected all the potential interaction points a product user might have with the product, and a Bullseye map that helped learners prioritize what features their product would have.

The process through which learners solved project problems using group genres is best described through Cook and Brown's (1999) notion of knowing-in-action (see Chapter 2 for a detailed discussion). Knowing-in-action is an ongoing "generative dance" (p. 382) whereby individual and group knowledge becomes an interplay between "what is part of practice as well as what is possessed in the head" (p. 382). Similar to Schön (1995), Cook and Brown refer to this interplay as an epistemology of practice, a way of re-defining how individuals co-construct knowledge and knowing together.

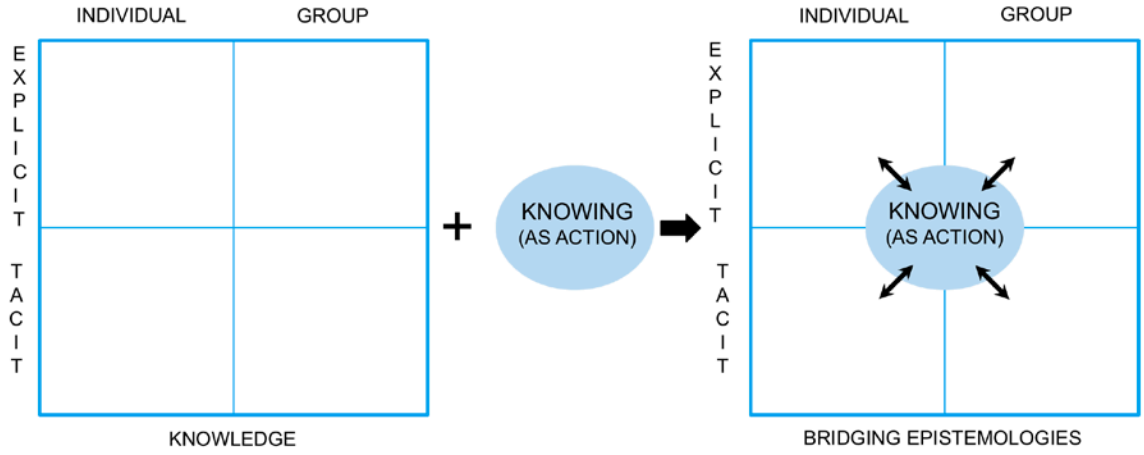

Figure 12: The generative dance (Cook & Brown, 1999). Redrawn with permission of Dr. John Seely Brown.

Epistemically, individual and group knowledge in PjBL becomes "what is possessed". Knowledge is defined by the processes, tools, practices and previous experience that the individual and group already possess and bring to the project room. Individual and group knowing becomes "what is part of action" (p. 382). It is a generative process that is the result of learners interacting with each other, the client, the project and the faculty mentor in-the-moment. So when an aforementioned visual map or

problem solving tool, like a mind map is used, it enacts Cook and Brown's (1999) model depicted in Figure 12. The group genre (mind map) part of "the body of knowledge … possessed by the group as a whole" (p. 386) is applied to solve a design problem and the action of using it in itself enacts individual and group knowing.

During this investigation, the role of the faculty mentors was to challenge learners to draw upon previously learned group genres in order to move the state of the project forward— to manifest knowing through action. They usually did so through Socratic questioning. The strategy itself can be seen as provoking Cook and Brown's knowing-as-action. Faculty mentors knew that learners could only solve contextual problems through action. A group genre in itself was only useful in so far as it afforded new knowing to emerge.

Similar to Cook and Brown, faculty mentors did "not expect every individual in a group to possess everything that is in the 'body of knowledge' of that group" (p. 386). Individuals on a team relied on each other to 'fill-in-the-blanks' where and when necessary. In doing so learner and faculty mentor applied known group genres to solve new problems.

In the case of one team, for example, learners were challenged to document a client meeting in a completely different way than what they were used to. Usually, learners documented a client meeting by assigning one team member the task of writing minutes, with special attention to transcribing important information that the client had said. During several client meetings where the team was pitching an idea to the client, however, the tables were turned; a research assistant was assigned the task of capturing what learners said as a whiteboard drawing in order to serve as a visual representation that they could refer to in the client-meeting debrief with the faculty mentor.

> They all gravitated to M's graphics and I don't think we would have had a session without the board there. They had time to take in the entire board. I reminded them that this was someone that had no briefing on what they

> were going to pitch. She knew nothing. She wrote everything on the board. I asked her to write things she specifically heard from the students. So they were looking at an annotated transcript of their pitch (mentor 1).

Learners were then tasked to interpret the whiteboard drawing and in doing so, realized that essential messages they intended to communicate in their pitch to the client, were missing. Graphically recording their ideas then reflecting upon them was also intended to set precedence for future meetings. As the faculty mentor asserted "the idea of [mapping] what they were saying is not only to visually show what they were presenting but also an example that they also need to start transcribing things for themselves" (mentor 1). The knowing that was generated through the action of graphically recording their pitches generated both individual and group knowing. Individual learners had a direct feedback system in order to reflect, refine and improve upon their individual contribution to the pitch. The group was able to assess the strengths and weaknesses of their combined individual efforts in-the-moment. The knowing that emerged was impactful enough for the team to assimilate the tool as a group genre. As the data from the learner interviews revealed, the experience itself was recounted as a foundational group 'war' story.

Memorable Experiences

Individual war stories, in which they shared their memorable experiences were also used by faculty mentors for a variety of reasons. Faculty mentors narrated stories from the past where a lesson was learned. When stories were recounted in the context of mentoring learners on projects, they provided learners with a perspective of "how it's been done before"; what the faculty mentor did when faced with a similar situation, problem or challenge. All faculty mentors made reference to experiences from the past at some point in the mentoring process. One faculty mentor, a graduate of the MDM Program in 2009, applied the use of the war story to empathize with learners. In explaining about similar challenges he had experienced as an MDM learner, he was able to affirm that the process of solving ill-structured problems on projects was a challenging

yet rewarding experience. Moreso, solving ill-structured problems provided learners with a "more real" experience of what they might expect working in the video game industry.

It is as Cook and Brown (1999) propose, that an individual's "account only becomes a 'war story' when it is held in common and can be used by the group in its discussions" (p. 386). To provide a grim reality check to learners about the industry they so passionately wanted to get into, another faculty mentor told a story about his own experience, when he, along with an entire team of employees, were laid off. The story was recounted in order to provide learners with a real-life lesson that they were currently experiencing with a client whose business went bankrupt. It was also an attempt to disrupt the notion that learners could rely on procuring a stable and long-lasting job in an industry burdened by volatile external market forces, layoffs and mergers. Here, the faculty mentor offered learners a life-lesson that extended beyond the 'safer' realities of a project course within the confines of an academic institution.

> The more that they can go into an industry being realistic about the risks allows them to keep their eyes open and … not become loyalist but good employees for the time that they have with a particular company or project. And that's just professionalism. It's just staying focused with the job at hand rather than I've got this job for life (mentor 1).

Targeted tools to manage client expectations

Learners were persistently challenged to manage their relationships with clients at the MDM Program. In their interviews, many learners attested that this was one of the greatest values of the PjBL process. The faculty mentor's role facilitating client-learner relationships was vital. All other aspects of the project including the process, scope, problem to solve and final digital artifact were dependent on the rapport that learners created with their client sponsors. As mentioned previously in this chapter, that is why recordings of the mentoring sessions following client interactions were such a rich source of data. Learning how to manage the client interactions was an important characteristic of

a self-regulating team. So, what strategies were used by faculty mentors to empower learners to manage their clients?

Beyond direct feedback, modelling and reflection, one faculty member affirmed the following:

> I've tried to continually tell them that the language they use should match up to the client. I told them you know that in this industry it's not standardized … there's so many terms for the same thing. When we went to the client meeting we heard the terms they like to use. Use the same term in whatever we're talking about (mentor 2).

Strategically managing the client included understanding the language that the client used to express their ideas. In doing so learners became accustomed to the explicit knowledge that the client shared. The team assimilated a client's use of specific vocabulary and this terminology became a genre explicitly shared in the group. Understanding the client's language eliminated some of the communication barriers and helped learners avoid misunderstandings and wasted time. Conversely, learners were challenged to articulate their own explicit knowledge to the client, along with the lexicon of terms that they had assimilated through their previous semester at the MDM Program. These were terms and processes that a client was not necessarily familiar with.

Paying attention to the client's use of vocabulary also made learners exercise a more focused listening. In another example, a faculty mentor exclaimed that learners had to relate the design of the game to the client's communicated aesthetic: "Keep it simple. Think about your childhood experiences" (mentor 1).

Another strategy conveyed to learners so that they remained aligned with the client was the practice of graphical notation. One learner was usually tasked at client meetings to take minutes of the meeting so that all parties would have a document of what was said and agreed upon. The recording of what was agreed upon at a meeting was also referenced in order to keep the project in scope. Minutes, reminded the client and the

team of what the team had agreed to work on in their next Sprint (see Appendix A). Doing so kept the client's expectations more clearly defined.

Productive Failure

Kapur (2008) defines productive failure as a process of "engaging students in solving complex, ill-structured problems without the provision of support structures (p. 379). Client interactions afforded learners many opportunities to 'fail' or make mistakes during meetings with the client. The identified errors in communication were reflected upon afterwards in order for the team to better understand why they had occurred, the consequences of making the mistake, and how they could prevent future errors from recurring. Allowing learners to make mistakes, leading in some cases to a complete breakdown in communication with the client at a meeting, while risky, produced an environment where learning could occur. As one faculty mentor expressed,

> I think that also in order for them to improve they have to have something to contrast it. So they know this was a bad meeting. Maybe that will stimulate them in their next meeting to be more on the ball. Failure is a learning opportunity. This was one they failed so maybe they'll use that as an opportunity to pull their socks up (mentor 2).

The same faculty mentor articulated in a subsequent stimulated recall session that "meetings have improved exponentially" (mentor 2). The important accompaniment to the strategy of letting learners 'fail', was ensuring that time was taken to reflect with the team afterwards. This allowed the solution to the problem to emerge from the learners through reflection, rather than having solutions imposed by the faculty mentor.

Managing the unexpected

All faculty mentors persistently surprised learners during client meeting debriefs. The purposes of these surprises were varied. Sometimes the use of surprise questions or challenges tested the learners' ability to articulate their own understanding of the project, their team members and the client. Learner responses allowed faculty mentors to gauge

"where they were at". One faculty mentor surprised learners by not providing them with advance notice of a peer-assessment session.

> I do it in this format rather than giving them anything ahead of time. Or even when they ask, 'So what's the purpose of this 360?'. I keep it very vague until I'm there, because I tend to prefer answers that haven't necessarily been rehearsed in their mind previously. I want to get their first impressions and then later on I can follow up and then they've had time to really think of stuff. I tend to believe that whatever comes out of their mouth first can be more along the truth. That's really what that person does. If I give them a lot of time to come up with an answer, there could be a lot of b.s. (mentor 3).

The strategy of surprise was used to keep learners "on their feet" and provided them the practice of generating unrehearsed responses regarding their performance and the performance of their peers. By not always preparing learners for what was to come, faculty mentors attempted to provide them with a sense of what the video game industry is really like. No matter how much preparation ahead of time, in real-world context, learners will likely have to contend with all manner of unexpected events.

The ill-structured nature of projects at the MDM Program also yielded surprises for one entire team, faculty mentor included. In a case previously discussed, one team lost a client nine weeks into their semester, as the client's company went bankrupt. Learners were told about the situation immediately after the client told the faculty mentor. The situation presented the faculty mentor with a unique opportunity to create a lasting and impressionable teaching moment. The faculty mentor modelled how a team might mitigate the situation in the real-world. "I took into account their lack of experience in the industry and felt like I had to demystify the industry" (mentor 1). The remote client also surprised the team by giving learners the option to continue developing their game for the company even though it had folded, or to publish the game on their own accord. The client also offered to remain as a consultant. For the faculty mentor

> the situation forced the team to pivot and be much more realistic of the fact that you're only as good as the last meeting you walk out of. Especially in

> today's world where everybody's considering every investment high risk, all of the markets are saturated and it's really hard to be original (mentor 1).

The unexpected situation and the faculty's management of it afforded learners a renewed independence and self-determinism that is rare in client-driven projects at the MDM Program. Learners on this particular team all attested to the value that the unexpected bump-in-the-road provided them.

Humour

All faculty mentors used humour for different reasons, aligned with the intention to make the inherent challenges of solving ill-structured design problems at the MDM Program's PjBL environment a less frustrating and at times, challenging experience. By downplaying the complexity of certain design problems and their team's occasional inability to identify problems that emerged, faculty mentors gave learners permission to see their contributions as part of a generative process.

Humour was used by one faculty mentor to soften the intense self-criticism that learners often demonstrated. While being self-critical is an important aspect of the self-regulating learner, at times learners would "beat themselves up" (mentor 1) unnecessarily. This was particularly true during and after client meetings, particularly if the client didn't respond well to a learner's idea. "I teased her about it and joked with her and they got to laughing eventually" (mentor 1), one faculty mentor exclaimed. Of course, accompanying the humour was always some kind of lesson. In this particular case the learner was unable to articulate their game idea to the client clearly, so the client dismissed it entirely. In the debrief session the faculty mentor mentioned that the reason why the learner's idea was not liked, was due to the learner's inability to articulate the idea in simple terms that the client could understand. In their one-on-one interview the same learner confirmed self-initiative when they mentioned that from that point onward they were "determined to get it right next time" (learner 7).

5.1.4. Section 2: Triangulation with final learner interviews

In this section I will first detail the data collected from a total of eighteen learner interviews at the end of the Action Research phase and describe how I organized the data. I will then compare this data with the typology of mentoring strategies described in the previous section.

The eighteen learner interviews were transcribed verbatim. I then searched the transcripts looking to specifically extract:

- learner impressions of what they thought the mentor did to support them during the project;
- learner impressions of what they felt they achieved during the project.

Learner impressions were then organized as per Table 2. Column one represents a quote from the learner that made direct reference to the mentor's role, implicated a strategy the faculty mentor had used, or revealed the learner's embodiment of a characteristic of self-regulation. Column two provides my interpretation of the learner impression.

Table 2: Excerpt from learner interviews conducted at the end of the AR process

Learner Quote	Interpretation
He was more like a mentor (learner 5).	Faculty as mentor.
It was more the entire experience of the team setting their own rule (learner 14).	Mentor facilitating learners setting their own team rules revealed self-determinism
Our team needed to show ownership of the project (learner 11).	Reveals a characteristic of both PjBL and self-regulation.
It's not like the mentor would say you have to do this [more like] … I would have done it like that (learner 9).	Faculty mentor's advice was not prescriptive although feedback was offered.
He was good about not being hands on, on the project (learner 8).	Faculty mentor distance revealed empowering learners to take responsibility of the problem solving process.

Learner Quote	Interpretation
If he had he would have been more like the lead of the team and things would have shaped up differently than the way it did (learner 2).	Learners revealed that the project lead was not the faculty.
He gave us the freedom and he had hands off approach. I wouldn't say it was completely hands off though (learner 3).	Showed that the faculty mentor at times demonstrated increased self-regulation on some occasions.
Mentor realizing that the team is drifting so that's where he spoke from experience of what could be done. He never told us to do anything (learner 5).	Again a fine balance between mentoring self-regulatory behaviors and demonstrated teacher self-regulated behavior.
You need to take ownership of things (learner 3).	Aspect of self-regulation in the PjBL literature.
There is a sense of composure when [mentor by name] is around. He has an incredible ability to listen…to let team talk when it needs to but also he has an incredible sense of not letting the conversation divert completely (learner 15).	Showed faculty mentor had a calming effect, would listen but also keep team focused if necessary.
He also interacted differently with different people (learner 9).	Revealed a back and forth movement from mentoring the team to mentoring an individual.
Everyone agreed that one-on-one with [mentor] helped…. if you want more then you could have more time (learner 9)	Showed the importance of the faculty mentor being available to the mentee individually, not just the team.
The way I perceive projects is that it should be my responsibility. No one should spoon feed me (learner 17).	Reveals characteristics of self-regulation: Self-reliance and self-determinism.
If someone was arriving late in the room and there is this visible tension, I tried to modify and mitigate that sort of tension. And if there is big presentation and if team mates had to prepare then I felt I shouldn't get involved in it … at times I wasn't really happy with the presentation so I wrote the script for the entire final presentation (learner 6).	Revealed pro-active behavior that faculty mentor did not prescribe, demonstrating self-reliance and self-motivation in that individual learners supported one another.
He was a guide for us. He didn't impose (learner 12).	Revealed unobtrusive guidance.
Sometimes when he felt we were going in the wrong path he would give us suggestions in order to do it better (learner 13).	Demonstrated feedback and orientation.
He was not either too much with us or too little. It was a good balance (learner 15).	Demonstrated that the amount of time the faculty mentor spent with the team was well-balanced.
At the beginning he stayed longer with us. The first month every day and eventually less and less time with us (learner 11).	Revealed fading.
At the end he stayed a little bit longer. He left us with more challenges that we were developing in the project (learner 3).	Demonstrated more of an ebb and flow of mentoring challenging the view of fading over time.

Learner Quote	Interpretation
Even though a simple meeting with the client, he was always telling us to prepare, any type of communication. He would always advise for us to be the ones that guide for the project (learner 4).	Feedback on being well prepared and that ownership of the orientation rested on the learner.
Even though the project may not be that appealing to the team you have to have the energy up and you can always get good learning form any kind of project (learner 5).	Revealed a sense of commitment to the inherent learning involved in PjBL and that even though buy-in was not fully present, there was still motivation to learn.
I valued that you have to be connected with your team. It's a major element in the success of your project (learner 8).	A sense of connectedness and alignment also demonstrated that the faculty mentor facilitated the team itself to be self-determined.
The decision was always with us but he made a lot of neutral, very objective comments re: his experience (learner 2).	Again, demonstrated the facilitation of decision-making made by the team for the team.
There was no other choice than using Unity. I read about best practices and what we could develop … even though we didn't know what we were going to develop we knew it was going to be in Unity. That was part of fulfilling the goal, researching, documenting stuff. Also because we had to test the box. I took the task of testing lighting, animation, and this also helped me for researching and documenting (learner 1).	Demonstrated pro-active learning on the part of the learner and their propensity to take control of their learning process.
I got feedback a little bit from [faculty]. I used to ask questions from others to get feedback from [client team] and I got very good feedback and I could solve the problem or issue and I felt I was making good progress (learner 13)	Solved problems by asking the faculty mentor as well as collaborating with client team and not being afraid to ask questions to support problem-solving.
I was always thinking of [faculty] as a facilitator for any bomb or struggle we could have while developing the project and that means ah … well designing, discussing, arguing , defining and stuff like that (learner 7).	Revealed the role of the faculty mentor as facilitator and showed that the faculty mentor had multiple roles.
Sometimes he was just there sitting and listening…. Otherwise he would not interrupt unless there was a struggle with something and he would suggest something, which doesn't mean what he was suggesting was the answer to our problems (learner 16).	Implies the strategy of silence…of the faculty mentor being present but not saying anything—remaining observational.
Sometimes I didn't like that when the team was doing that because I would tell them this is our decision this is what we think. We are the ones designing the thing. And if we think this is where we should go and if [faculty] thinks the opposite and we think it's not the way to go we shouldn't listen to what [faculty] says (learner 3).	Revealed learner challenging the rest of the team about the faculty mentor's role, yet still turning to faculty for affirmation in some cases. Learner also demonstrated a high degree of self-autonomy and a desire to want the rest of the team to also be self-deterministic.

Learner Quote	Interpretation
But sometimes I would also need that feedback … I don't know should we do this or that? Then I would confirm with [faculty]. I knew asking [faculty] wouldn't be the solution. He would not give us a solution. He would not suggest something You should decide. When I noticed I wouldn't get a final solution from [faculty] then I would ask what he thought (learner 4).	Learner knew that the faculty mentor was present but used their knowledge in a very specific negotiated manner revealing independence.
It's interesting cause I always and we know how we act in front of clients we are aware of that…but even though we know that sometimes we just need someone to tell us you're doing this or that … even though you know … it's weird (learner 10).	Faculty mentor acted as mirror.
He mentioned that at least someone should be like paying attention to your teammate maybe just doing things with your head. I know that. But sometimes it just happens. After that, it sticks in my mind. When someone is presenting I force myself to do that. I remember myself. Move your head, look at him, pretend that you are there even if you're not there (learner 11).	An important point as it directly reflected a captured moment on one of the recorded mentoring sessions, revealing that the mentor's advice did stick. In some ways this also revealed evidence that the mentoring was working.
In this project I was forcing myself not to be direct or 'What you're saying it doesn't make sense" and I think I shifted to understanding that people we're all different and everyone has a different way to solving things and even though you're way is not the best way to solve it and I know that. We can still go with your way and by doing your way we can all find out it's not the best way but we can do it some other way. Before that I was always thinking you're wrong and I'm right or you're wrong and there should be a different way to do it and I know that this is not the way and I would just stop everything (learner 3).	Revealed a desire for team cohesion, alignment and a sense of commitment to individual ideas on the team, even if at times this individual felt that their team mate's ideas were not that good.
Sometimes I just wanted to sit down and listen to everyone instead of trying to think (learner 7).	Reflected the challenge and difficulty that learners sometimes faced when charged to take ownership and be self-reliant.

The next step of the process was to re-organize the quotes I had extracted in such a way as to:

- Indicate the learners' perception of the faculty's role on the project in order to triangulate their primary role as mentor to what is described in the literature. These

emerged as three different types defined by as much by learner's perception as to what the mentor did;

- Reveal self-regulatory behaviors that were 'learned' through the faculty's mentoring during a project's cycle.

Learner Perception of Faculty Role

The learner expressions of the faculty's role were categorized into three types: the first by name, the second by what the faculty mentor did not do, and the third by what the faculty mentor did. I will discuss each and provide examples from the learner interviews.

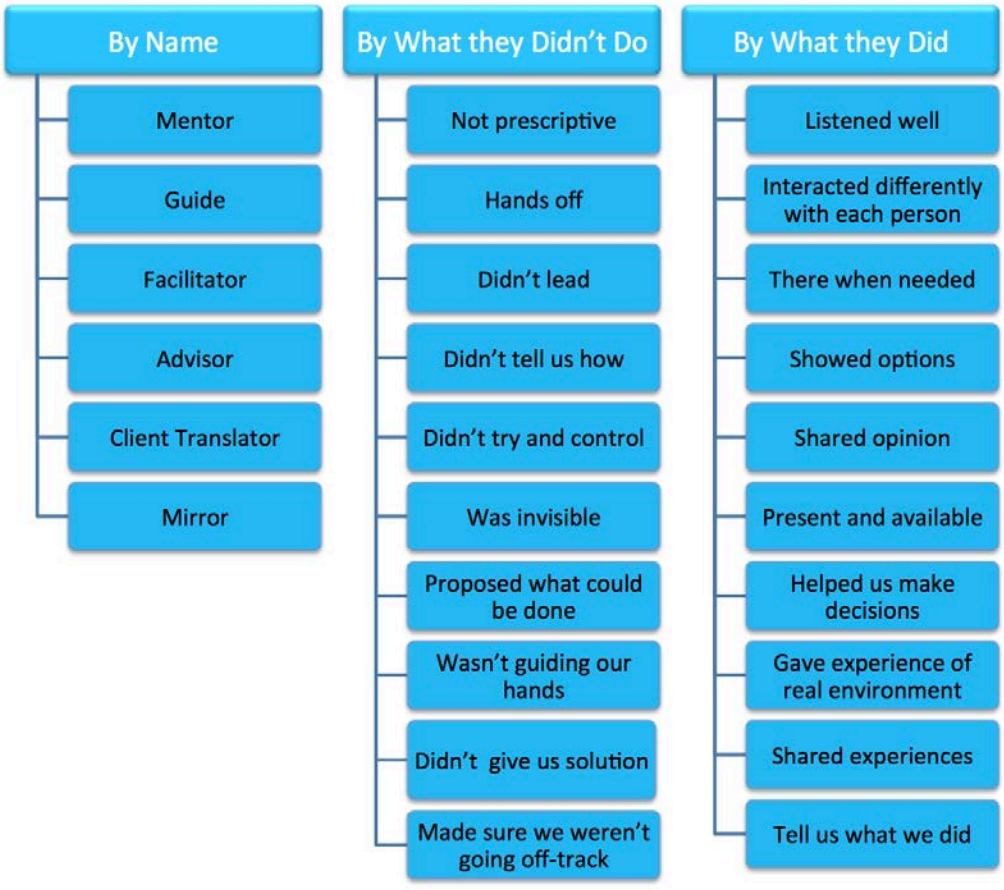

Figure 13: A typology of the faculty's role as expressed by learners

By name

How learners perceived the faculty's role directly referenced the word 'mentor', variants of this term or provided aligned definitions of mentoring from the literature. Some quotes that stood out from the interviews included:

- He was more like a mentor (learner 5);
- Facilitator for any bomb or struggle we could have while developing the project (learner 7);
- It was a kind of mentorship (learner 13);
- He was really present and that was important (learner 10);

When it came to bridging the relationship between learners and clients, one learner observed that the faculty as mentor "had an insight on his end" when the "client would say something and we were like: 'What the hell is going on" (learner 3)"? Many quotes extracted from end-of-research learner interviews implicated the faculty's intention to support self-regulation. How the faculty mentored self-regulatory behaviors were derived from the learners' perceptions of what the faculty mentor did and did not do.

What the faculty mentor did not do

Many of the interviews described the faculty mentor's role according to what they did *not* do. In fact, these types of comments seemed easier to express than what the faculty *did* do. One learner mentioned that the faculty mentor "would not interrupt unless there was a struggle with something and [they] would suggest something" (learner 7). This observation affirmed the faculty mentor's observed behavior during a video-recorded session. The faculty mentor was "present but not saying anything and just observing at other times" (learner 13). Often learners in a variety of different ways affirmed that the mentor made sure the team was, as one learner expressed it "not going off-track, going down a path that would be bad for the project" (learner 10). For one

learner, however, a tenuous line was struck as they observed: “When I noticed I wouldn’t get a final solution from [faculty mentor] then I would ask what he thought” (learner 3). Some learners on some of the project teams continued to ask the faculty mentor to provide a solution, despite the faculty mentor’s best intentions to facilitate the team in providing their own.

More common, however, were reflections like the ones below:

- He wasn’t doing it or guiding our hands but more like advice (learner 7);
- He wasn’t there like guiding us. We were doing it (learner 12);
- The decision was always with us but he made a lot of neutral, very objective comments regarding his experience (learner 17);
- He gave us the freedom and he had a hands off approach. I wouldn’t say it was completely hands off though (learner 3).

In terms of the faculty mentor’s support of productive failure one learner noted:

> I learned by actually doing the thing and failing. You have the emotional part connected to the experience. It helps me remember what to do more when I do this. I shouldn’t do this because that really hurt me bad when I did this. Now I know. I have this piece of information connected in my brain. Now I know I shouldn’t do this (learner 6).

By what the faculty mentor did do

Of course balancing learner perceptions of what the faculty mentor did not do with what they actually did, revealed more useful data from which further assertions of self-regulatory behavior could be drawn. Some observations, like the following quote, add weight in the definition of the faculty mentor representing a community of practice: “What they have given me is awareness. [He] has a lot of inside ability as to how things work” (learner 9).

The habit of listening to learners was affirmed when one learner attested “he has an incredible ability to listen, to let team talk when it needs to but also he has an incredible sense of not letting the conversation divert completely” (learner 15). In pointing out that the faculty mentor had a sense of not letting the conversation divert, the learner was implying that the faculty mentor was also regulating the team to a certain degree. One learner expressed their dislike of fellow teammates who kept looking to the faculty mentor for affirmation of a decision they were thinking of making. “I would tell them [the team] this is our decision this is what we think” (learner 3). The same learner noted “I knew asking [faculty mentor] wouldn’t be the solution. He would not give us a solution. He would not suggest something. ‘You should decide’” (learner 3).

Faculty mentors often approached a project team with the assumption that learners were capable of “solving problems for themselves” (mentor 1) and that they would only interfere if the team needed support. The approach was affirmed by one learner who claimed that when the faculty mentor “felt we were going in the wrong path he would give us suggestions in order to do it better” (learner 15). Another learner observed that “if we were going down a path that would put the project in jeopardy [the faculty mentor would suggest] ‘Maybe you guys want to do this’ (learner 14).

Implicating another manifestation of modeling is the example of the faculty mentor who provided feedback and it provoked one learner to ask for feedback from other learners and the client team. “I got feedback a little bit from [faculty mentor]. This made me ask questions from others and get feedback from [client team] and I got very good feedback and I could solve the problem or issue and I felt I was making good progress on my own” (learner 2).

By what learners managed

A superordinate definition of self-regulation is the idea of a person managing their own learning. PjBL environments afford learners the opportunity to self-regulate since

they are challenged to manage all the things that they need to learn in order to successfully contribute to the co-construction of a project. Those 'things' they need to learn are numerous, including how to improve their collaboration with team members, how to manage the client relationship, and how to improve their own hard skills so that they can contribute to a project to the best of their ability. They learn how to scope a project, manage their time, identify problems, how to manage the actual project pipeline or process, how to communicate with a client, how to organize a meeting, how to identify and solve ill-structured design problems, and more.

Organizing all that learners needed to learn to manage, I derived three inter-related categories building from the one I developed in the pilot study (Figure 7). The refined typology is illustrated in Figure 14. Categorizing in this manner, allowed me to relate each category with the specific strategies that faculty mentors used to support the learning that occurred.

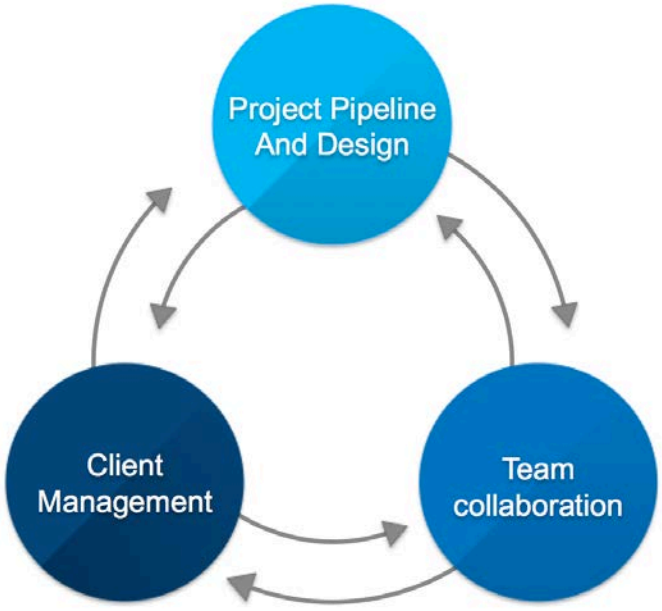

Figure 14: Learner self-regulation management typology.

Data from the eighteen learner interviews (Table 2) were re-organized according to how they related to the learners' management of the project, each other and the client.

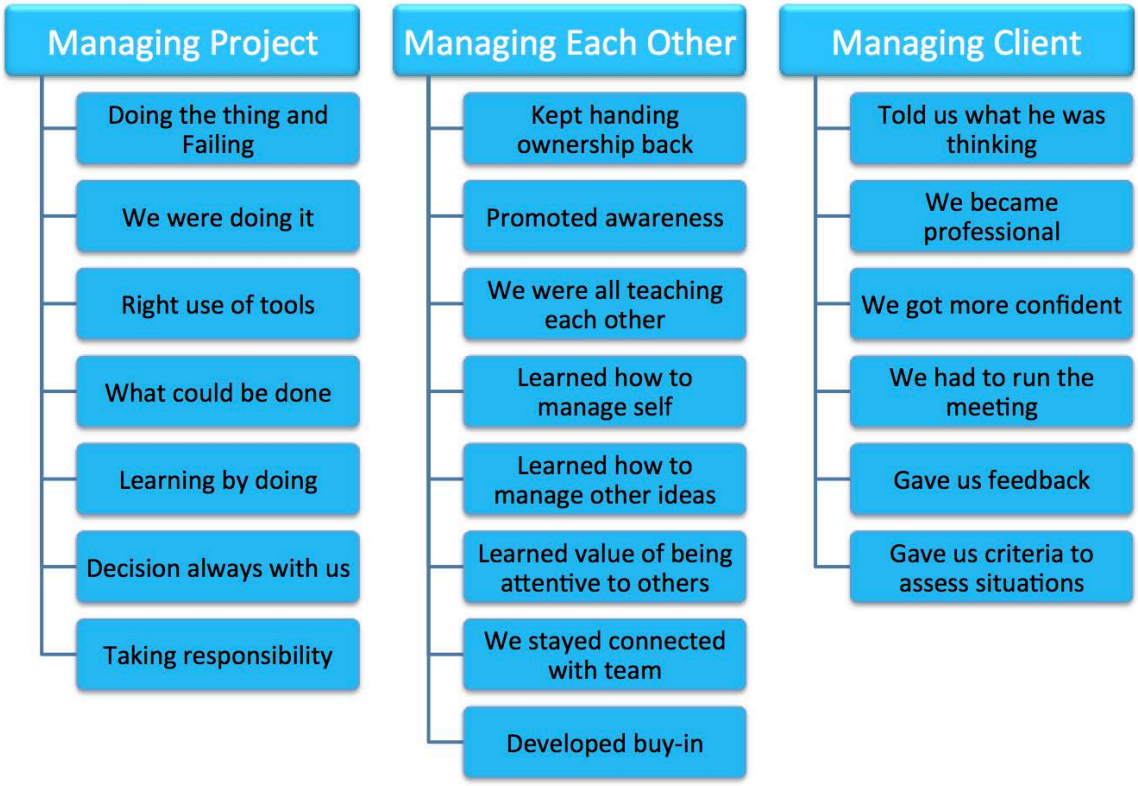

Figure 15: Learner self-regulation management typology elaborated

Management of the project

Learners persistently teeter-tottered between demonstrating self-reliance and depending on faculty mentors to make decisions for them or regulate the team, project and/or the client. Learner perception of the faculty mentor was often spoken of as a guide. From one learner's perspective,

> the role is to help us make decisions and understand the situation and assess things in a way that is coherent and [to] help us be conscious of what's going on. [Their] purpose is to make us aware of the decisions we are making and why we are making them and learn to plan (learner 16).

The post-client meeting debriefs also afforded areas where learners recognized the importance of managing all aspects of the project based on faculty mentor feedback.

> He made a lot of feedback on how we conducted the meeting. 'You had the agenda but you missed this point. The meeting took another approach. You didn't conduct the meeting as well.' He noticed and gave recommendations to us and also he could understand other things about the client that the client didn't know. 'They didn't know sometimes what they were building' (learner 5).

Project teams were always faced with learning from the different collaborative design challenges that emerged, in part informed by what the identified problem-to-solve was. What they needed to learn was also dependent upon the unique demands that the client or project placed on the team. One learner's perception of their interactions with the client was that "a lot of what we did was based on pitches. [The faculty mentor] "would sit down and talk to us of [their] own experiences and how [they] would pitch things to [their] clients, the little things" (learner 12). By incorporating those "little things" into their pitches, learners received improved affirmation from the client that they were on the right track. Those added 'things' became part of both individual and group knowledge.

As discussed earlier, what the team learned was added to a growing list of group genres that they could draw from. Importantly, learners also asserted that the PjBL process enacted "learning by doing". In many cases, individual and group learning enacted Cook and Brown's (1999) model of knowing-in-action. For example, in the case of organizing a client meeting, one learner repeated what their faculty mentor had taught them. "Set the objectives. Know what the agendas are for meetings. You have to lead the meeting. Go" (learner 7)! Setting objectives and an agenda for the meeting enacted a group genre (OARRs) and knowing manifested through leading the meeting (action).

Taking charge of meetings also revealed how learners regulated their client. This was recounted by a learner on a team telling the story of how they were

> trying to get approval on the art style and [the faculty mentor] said instead of just making all the 3D assets why don't you just do a storyboard and walk him [the client] through the entire experience. We're like 'ok let's do that'.

> I think that was the first time he [the client] understood every single part of the game (learner 10).

In guiding the client, the team learned that in this case their propositions were affirmed. “Go ahead and do that” [learner imitating client voice] (learner 7).

At times the role of the faculty mentor was as learners suggested, to steer them “down the right path”, often anticipating what a client might say in subsequent meetings. In the above example, the client’s affirmation of the team’s proposition engendered a growing trust between learners and the faculty mentor.

Management of the client

As alluded to throughout this dissertation, the process through which the team learned how to manage the client’s expectations, revealed self-regulatory behaviors. Mentoring the learner-client relationship was also unique to each client and project. Faculty mentors supported learners in managing client expectations before and after client meetings.

As faculty mentors were present at all meetings with clients, they acted as a translator for some of the needs the client was attempting to express; some of which would at times baffle learners. As one learner expressed “Sometimes the client would say something and we were like ‘What the hell is going on?’ And [the faculty mentor] had an insight on [their] end. ‘This is probably why he said this.’ [learner imitating their faculty mentor’s voice]. Oh yeah that makes sense” (learner 3). For another learner the faculty mentor’s previous professional expertise was essential.

> It gives you that extra knowledge or criteria to assess situations and you couldn’t have if you were alone in the real world, because I don’t have the experience to make calls because I don’t have enough information. He in his experience has the information that we lack (learner 18).

The role of the faculty mentor in terms of supporting learners to manage their client’s expectations was to model a process of more deeply deconstructing what the

client had said. “What he’d do a lot of, he would dissect and parse what the client said and this is what he said. When we followed that we hit it right on” (learner 17).

As discussed earlier in this chapter, faculty mentors also challenged learners to learn how to maintain control of the project through managing their client’s expectations. This was evident in the faculty mentor’s advice to “Prepare, even though it’s just a simple meeting with the client” (learner 4). Moreso, when the same learner exclaimed “he would always advise for us to be the ones that guide the project” (learner 4). From the lens of self-regulation, the learner realized that the faculty mentor assigned the responsibility of managing the client and project to the team. The faculty mentor also challenged learners not to solely deliver what the client wanted, but to co-construct a project that the team also aspired to achieve.

Lastly, a strategy that faculty mentors often practiced was to act as a “fly on the wall”, remaining observational of learners during meetings with their clients. The strategy was usually reinforced by silence, letting learners productively “fail” during their client meetings. Importantly, the observed failures at meetings were always followed by the faculty mentor reporting their observations to learners in post-client debrief sessions. Many learners affirmed that “the entire debriefing session after each client meeting was really helpful” (learner 8) in this regard. During those debriefing sessions faculty mentors would also challenge learners to understand what the client had communicated or requested, if their ideas of the project had changed and why the client may have reacted negatively to their ideas. The importance of having the experience of interacting with a real-world client was emphasized by one learner who claimed that “it’s all in the doing of the thing, experiencing the project. Actually doing it with an actual client with actual demands in an actual context. There’s no pretense about it” (learner 18).

Management of each other

Learners also demonstrated self-regulatory behaviors by learning to manage each other. This was evident in one example where the faculty mentor in a recorded mentoring session proposed “you should always acknowledge what your teammates are saying verbally or non-verbally” (learner 4). In the final interviews with learners, the faculty mentor’s advice was almost repeated verbatim when one learner exclaimed they had learned the importance of “paying attention to your teammate maybe just doing things with your head” (learner 4). While seemingly superficial and with no way to prove or disprove whether ‘real’ attention directed towards their team members actually transpired, what was revealed was that the learners were able to use a very specific group genre for behaving performatively during a client meeting. Doing so demonstrated alignment with their team mates.

An even stronger demonstration of the desire for learners to regulate each other was expressed by one team member who asserted that they “learned how to manage small teams, to be more Agile. All the tools are totally spot on and I ended up using them” (learner 16). As described in Appendix A, learners were tasked to co-facilitate daily update meetings, to Scrum. In a typical Scrum learners took turns providing an update of their project-related activities as well as detailing how other team members could support impediments they might be contending with. As one learner claimed:

> Doing Scrum helps me understand where each person of the team is at. I can be more helpful in assigning roles, or connecting people. You’re doing this and you’re doing this. Why don’t you talk to each other at this moment so you can solve this problem at the moment (learner 15)?

Referencing Cook and Brown (1999), Scrum could also be discussed as an explicit group genre that served to keep all team members aligned.

Another example of learners regulating each other occurred when one learner stated

> When we were doing ideation, people [team members] would say let's do this and this and this. I would start with a low position and say I am not a game designer so I won't tell you what [or] how to do your game design but what if we considered the possibility of putting all the ideas separately and then bringing them together in a specific session where we solve a problem and put them on the board (learner 12)?

As the learner was attempting to guide their team members, they noted that another team member jumped in and "supported by saying: 'Oh we can create a visualization of all our ideas on the board'" (learner 12). Demonstrating they too had the capacity to mentor, the learner also expressed that "at the same time people don't think that you're controlling them but you are at the same time trying to lead them down a particular path" (learner 12). The attempt and impulses that some learners engaged in, in order to regulate other team members revealed an interesting layer to the self-regulating team. The regulation of self, team member and client became an embodied group genre that learners engaged in, especially towards the end of the project cycle.

Further evidence emerged from the interviews when another learner asserted that "everyone was teaching each other and everyone was learning from each other" (learner 8). Another learner stated "we were teaching each other all the time" (learner 17). Finally, in terms of managing self, one learner expressed that "I keep learning things about myself that I didn't know before. It's like becoming part of me, becoming part of the professional I want to be" (learner 7).

5.1.5. Triangulation of learner interviews, video-recorded mentoring sessions and faculty mentor stimulated recall sessions

By triangulating the mentoring strategies from the typology (Table 1) with learner interviews (Table 2), my objective was to increase my understanding of what bearing the mentoring strategies had on team and learner self-regulation. This comparison allowed

me to potentially match faculty mentoring strategies and learner experiences, in order to see if there was alignment. Close matches in the data did surface between mentoring strategies and learner interviews where terms, processes or techniques that the faculty mentor had proposed, re-surfaced in the learner interviews. Column one in Table 3 reveals quotes from learner interviews taken from Table 2. I aligned these with related quotes in column two from faculty mentors as extracted from the stimulated recall session transcripts taken from Table 1. In the third column I have interpreted the aligned quotes through the lens of self-regulatory behaviors as identified in the literature.

Table 3: Comparing learner perceptions of faculty role, with faculty mentor data

What the learner said	What the faculty mentor said	Interpreted self-regulatory behavior(s)
Our team needed to show ownership of the project (learner 11). You need to take ownership of things (learner 3).	I have to reinforce that I'm just filling their toolbox, otherwise it'll be me directing their project which will take away from their ownership of it (mentor 1).	The pressure of having a real client motivated learners. Aspect of SR in the PjBL literature.
Good about not being hands on, on the project (learner 8).	If I was to recognize an issue and before the meeting said ok we're going to have a preparation meeting. Make sure you guys are all dialed in, is then their performance in the meeting, real performance? Or is it coached performance? And if I keep doing that, the first time I don't do that, will they do it? Or because they've had that support and prop they won't do it because somebody didn't do it for them (mentor 2)?	Faculty mentor revealed distance. Faculty mentor facilitated learners setting their own team rules revealed self-determinism. Revealed self-reliance and self-determinism.
Mentor realizing that the team is drifting so that's where he spoke from experience of what could be done. He never told us to do anything (learner 5).	So what I needed to reinforce was some of the things that went well so that when they realized they weren't pitching core ideas, they were still ok with themselves (mentor 1).	Again a fine balance between mentoring self-regulatory behaviors and demonstrating teacher self-regulated behavior.
If someone was arriving late in the room and there is this visible tension, I tried to modify and mitigate that sort of tension. And if there is big presentation and if team mates had to prepare then I felt I shouldn't get involved in it. At times I wasn't really happy with the presentation so I wrote the script for the entire final presentation (learner 6).	I want them to catalyze their rapport with each other (mentor 2).	Revealed pro-active behavior that the faculty mentor did not prescribe, demonstrating self-reliance and support for team members. Also revealed learners who tried to regulate the team demonstrating leadership.
He was a guide for us. He didn't impose (learner 12). Even though a simple meeting with the client, he was always telling us to prepare, any type of communication. He would always advise for us to be the ones that guide for the project.	The scope of your pitches were too big. He did not hear the core idea. You should be able to turn around and immediately tell him what the game's about. One of the things you can do is practice that (mentor 1).	Revealed unobtrusive guidance. Feedback on being well prepared and ownership of the orientation rested on the learner.

What the learner said	What the faculty mentor said	Interpreted self-regulatory behavior(s)
He has an incredible ability to listen … to let team talk when it needs to but also he has an incredible sense of not letting the conversation divert completely (learner 15).	I have them talk first before I provide my thoughts. Then in that case, I can immediately reinforce any thoughts they had which boosts their morale or "I'm on the right track type of thing (mentor 3).	The ability to listen and respond to learners was a common attribute of the faculty mentor.
Just little things that he [mentor] would say that would really improve our game generally When we first started pitching concepts for the game. 'For the next prototype [client voice] you guys build try to think of childhood experiences'. He [client] gave us a little talk how you could when he was making [game] he was actually thinking of hide n seek. It's visible how different the games were and how much more interesting they were (learner 7).	I've also tried to continually tell them that the language they use should match up to the client. I told them you know what in this industry it's not standardized. There's so many terms for the same thing. When we went to the client meeting we heard the terms they like to use. Use the same term in whatever we're talking about (mentor 3). Keep it simple. Think about your childhood" [mentor quoting client] (mentor 1).	This particular situation is almost verbatim of a lesson learned from the faculty mentor—a particular lesson learned from a client meeting and the debrief that followed.
I don't learn by being told what to do. I learned by actually doing the thing and failing. It helps me remember what to do ... I shouldn't do this because that really hurt me bad when I did this. Now I know. I have this piece of information connected in my brain. Now I know I shouldn't do this (learner 6).	In order for them to improve they have to have something to contrast it. So they know this was a bad meeting. Maybe that will stimulate them in their next meeting to be more on the ball. Failure is a learning opportunity. This was why they failed so maybe they'll use that as an opportunity to pull their socks up (mentor 2).	The strategy of productive failure was key here in understanding the tenuous balance between faculty mentor regulation and learner regulation that I will address in the Chapter 6 Discussion.

5.1.6. Summary of part two: Re-coding and triangulating mentoring strategies

As the triangulation showed, the learner data (Table 2) reinforced many of the strategies that faculty had used during the mentoring sessions. While close-to-precise matches could be drawn from some of the data, the important assertion was that the overall perception of the faculty's role was, as a mentor. Faculty mentors focused on

targeting their mentoring towards the team, supporting both team and learner self-regulatory behaviors.

The triangulation also revealed interconnections between what the faculty mentored and what the learners perceived that to be. To be clear, the intention of the faculty mentor was not solely to support learner self-regulation in their mentoring interactions with learners. That said, mentors did target their strategies towards facilitating an important characteristic of self-regulation in the PjBL literature: learner ownership of the project.

In Chapter 6 I will rework Dewey's (1941) argument of making warranted assertions and Stake's (1983) naturalistic generalizations, to make a number of propositions drawn from the typology of mentoring strategies (Figure 11) in the Action Research phase, as well as post-action research phase interviews with learners and mentors. I will also propose a model of mentoring self-regulation in PjBL environments.

Chapter 6. Discussion

The Discussion chapter is divided into several parts in which I will:

- Make warranted assertions (Dewey, 1941) drawn from triangulating faculty mentoring strategies (Table 1) in the primary Action Research phase, with faculty interviews and learner interviews (Table 2) conducted in the post-Action Research phase;
- Discuss how the conduct of Action Research itself increased understanding of the mentoring process by affording self-reflexivity for each faculty mentor;
- Contrast pre-research interview data collected from members of the game industry with learner interviews (Table 2) to determine what characteristics learners have developed that have been articulated by members of the game industry as must-have qualities.

In addition, I will also propose a new model to describe how faculty mentor self-regulation cyclically over time on project courses. Lastly, I will discuss the limitations of this research and propose future areas of investigation.

6.1. Warranted assertions

Warranted assertions (Dewey, 1941) are epistemologically aligned with Stake's (1983) notion of naturalistic generalizations. They consist of context specific inferences drawn from the data and reported by the researcher and offered to the readership to determine whether or not they can be transferred to a new research or learning environment. The act of making warranted assertions is complementary to an Action Research methodology as I am "more interested in generating knowledge that can be fed back into the setting under study than generating knowledge that can be shared beyond the setting" (Herr & Anderson, 2005, p. 7). That is, my primary motivation in making assertions is to increase our awareness of how we as a community of faculty mentors, support self-regulatory behavior in learners at the MDM Program. At the same time, I am reasonably sure that other researchers could also draw inferences from assertions that I make.

The warranted assertions that I make are drawn from the nine mentoring sessions and stimulated recall sessions that occurred in the Action Research phase, as well as the interviews with learners and mentors. Assertions are organized within the intersections of what faculty mentor learners to manage on projects: the project deliverables, learner and client relationships (see Figure 16).

6.1.1. Mentoring centered around client meeting debrief sessions

Warranted assertions are drawn largely from interactions that mentors had with learners during post-client meeting debrief sessions. Debrief sessions of client meetings tended to occur at the end of a weekly or bi-monthly process in which a particular prototype and/or state of the digital artifact was presented to the client. Debriefing client meetings offered faculty mentors an opportunity to provide feedback on how learners interacted with and managed the expectations of their client, how they managed the roles

they took on and the tasks they were responsible for in the co-construction of the digital artifact, and how they managed their relationships with one another.

The purpose of the debrief session also aligns with a self-reflective model of mentoring as noted in Wong and Premkumar (2007), supporting the mentee to "become a reflective practitioner" (p. 2). This is highlighted by the intention of the faculty mentor to support increased self-awareness on the part of the learner. Challenging the team in debrief sessions provoked learners to practice self-awareness and be cognizant of the impact of their decisions, a characteristic of self-regulatory behavior.

The debrief sessions are placed in the center of Figure 16, which, is an expansion of Figure 7 developed in the pilot study.

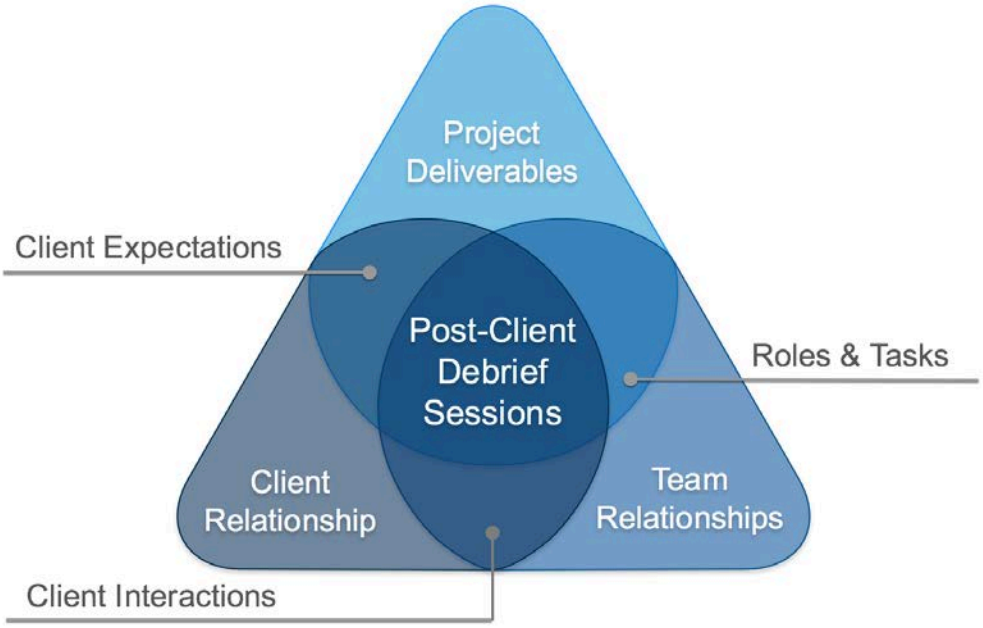

Figure 16: What faculty mentor learners to manage.

Strategies that faculty mentors used to support the improvement of learner relationships on teams reflect the cultural norms of the community of practice that learners want to transition into. They also supported learner-developed heuristics to solve

design problems. Finally, those strategies that supported learner management of the client were inclined towards relationship building, persistent communication and managing client expectations.

After describing each area or zone that the faculty mentored learners to manage (Figure 16), I will propose a number of warranted assertions. To finish this section, I will also propose assertions that are relevant to all three zones.

6.1.2. Zone 1: Management of the client relationship

When it came to managing the client relationship, faculty mentors approached the intervention with an eye to relationship-building, encouraging the team to be open to learning from the client as they also represented a community of practice. They engaged learners to empathize with the client, to anticipate a client's needs, manage client expectations and communicate clearly and persistently. Faculty mentors also acted as intermediaries between the team of learners and the client, prompting learners to reflect and learn from their interactions with the client. Each strategy aimed at improving learner awareness of how they interacted with the client, and how that relationship impacted the project itself. In this way they navigated learners through the uncharted territory of client management, challenging learners to develop their own management protocols. A clear example of faculty mentors guiding learners to manage clients was expressed by one learner in a final interview.

> It was a business research project. It was in our best interest to confirm what the client wanted to hear. He [the faculty mentor] wasn't saying give the client what he wants. He was saying give the client the answers he's looking for. Every time we presented to the client, we reflected back to him the kind of language he wanted to hear. We'd play up the things he'd want to hear. It allowed the client to secure a very lucrative deal with a game company (learner 17).

The complex dynamics of PjBL environments with real clients are a petri dish for self-regulatory behavior. Part of the successful outcome of the project itself hinges on the ability for the team to quickly learn how to manage every aspect of the project including their relationship with the client. The nature of the projects themselves and their fairly ambiguous requirements force learners to refine and propose solutions as they appear, agree on what is possible, co-create tangible artifacts representing a solution to the problem or need, learn from their successes and failures and manage the scope of what they can deliver.

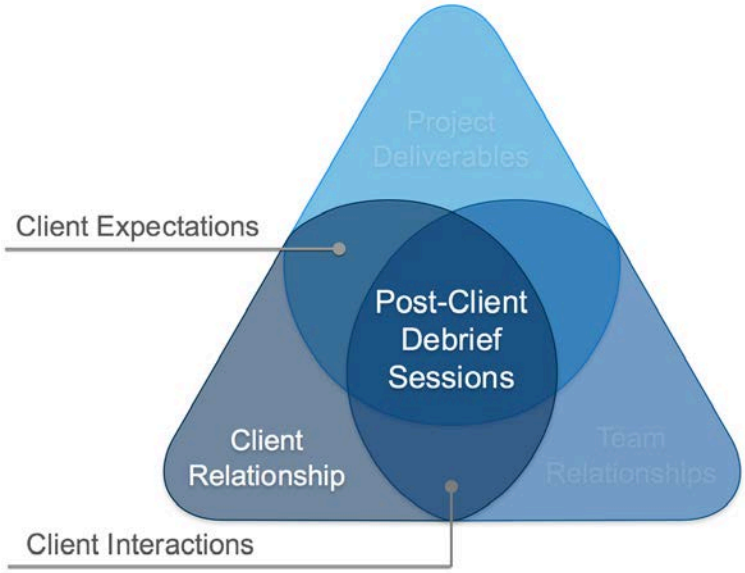

Figure 17: Mentoring learner-management of the client relationship.

Each assertion in Table 4 is organized within the intersection of the client relationship with the team relationships and project deliverables.

Table 4: Warranted assertions based on faculty mentoring the management of the client relationship

Assertion	Client Relationship (Interactions, Expectations)
Mentors model the behavior they expect learners to have during a client meeting.	Client interactions.
Mentors offer feedback to client initiated correspondence and guide learners on how to respond to them (ex. email, other communication channels). Correspondence is usually centered around what clients expects in terms of remaining aligned with the learners on the status of the project, next steps, and meeting times.	Client interactions and expectations.
Mentors tend to place more emphasis on reviewing how the client meeting was conducted in order to evaluate how learners organized and managed the objectives of the meeting.	Client interactions.
Mentors use the review to discuss how learners performed during a client meeting and question behavioral aspects and non-verbal cues that were communicated to the client.	Client interactions.
Faculty mentor self-regulation by focusing on listening to the learner's impressions of their interaction with the client first and then respond to those impressions by affirming, elaborating or proposing their own interpretation.	Client interactions, expectations.
Mentors observe how learners interact with a client at a client meeting and do not comment or attempt to correct or help them during those interactions. In a review of the client meeting they pose questions socratically in order to 'pull' the answers from the learners.	Client interactions.

6.1.3. Zone 2: Management of project deliverables

In terms of managing the project deliverables, faculty mentors challenged learners to develop their own design-oriented heuristics. Doing so included mentors modelling how they would solve specific design problems, and expecting learners to either adopt the approach or come up with their own innovative solutions— their refined group genres. They also provoked learners to anticipate problems before they occurred. They did so

employing a variety of strategies, such as war stories, that served as cautionary tales, or by challenging learners through Socratic questioning to make propositions that were then 'worked through', revealing potential outcomes if the team of learners chose a particular course of action. In this way, learners were encouraged to understand and improve upon the way that they solved problems— a characteristic of self-regulatory behavior that has been identified in the literature (Blumenfeld et al., 1991; Jonassen, 1999).

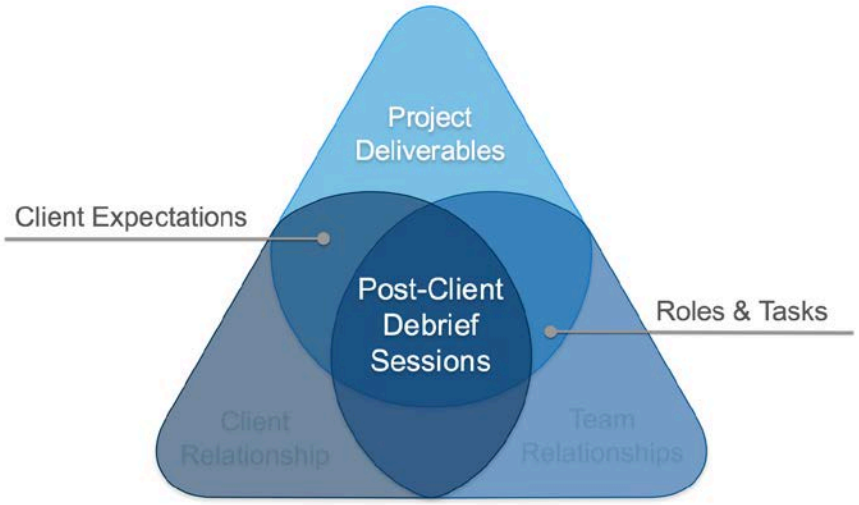

Figure 18: Mentoring learner-management of the project deliverables.

Each assertion is organized within the intersection of the project deliverables with the client expectations and the roles and tasks of each team member.

Table 5: Warranted assertions based on faculty mentoring the management of the project deliverables

Assertion	**Project deliverables (Client expectation, Tasks and roles)**
Mentors ask learners to articulate the next steps of the project ensuring that they align with what the client has asked and that they are moving closer to the agreed upon outcomes of the project.	Client expectation.
Mentors put learners on the spot with little preparation time in order to challenge them to articulate any aspect of the project from what it's goals are, to what team members are contributing.	Tasks and roles.

Assertion	Project deliverables (Client expectation, Tasks and roles)
As a project moves forward mentors increasingly take a step back even though the learners know that the mentors are there if needed.	Tasks and roles.
Mentors provoke learners to articulate their decision-making process.	Tasks and roles.
Mentors model asking questions that relate to the project and the problem they are trying to solve and will also provoke learners to do the same.	Client expectation, tasks and roles.
Mentors facilitate a debrief in such a way as to provoke learners to look at the situation, problem, and project through a new lens in order to propel the project forward.	Client expectation, tasks and roles.
Mentors prompt learners to use a specific tool or process they learned previously, that will be beneficial to them in solving the design problem at hand.	Client expectation, tasks and roles.
Mentors challenge learners on the scope of what they want to co-construct.	Tasks and roles.

6.1.4. Zone 3: Management of team relationships

When it came to managing their relationships with one another, reviews of client meetings provoked learners to think about how they managed problem-solving in-the-moment as a team. How did they support and learn from one another throughout the co-construction of digital artifacts? How did they self-regulate as a team? How did self-regulating their behaviors impact the project process? How aware were they of their dependency on one another to complete specific tasks that contributed to features of the project deliverable? For learners coming from academic backgrounds where they were used to being told what to do, the MDM Program's PjBL environment provided a very different approach. Faculty mentors employed a variety of strategies to support teams in managing their own learning through the co-construction of a digital artifact for a real-world client.

Additionally, learners were challenged to manage the role(s) they had self-defined on the team, learn what tasks they were responsible for, and understand the dependency that other team members had on their completion of specific tasks that contributed to the project deliverables. Personal responsibilities contributed to the team learning to manage the project pipeline or process itself, including time management and the implementation of a project management methodology inspired by Agile (Appendix A).

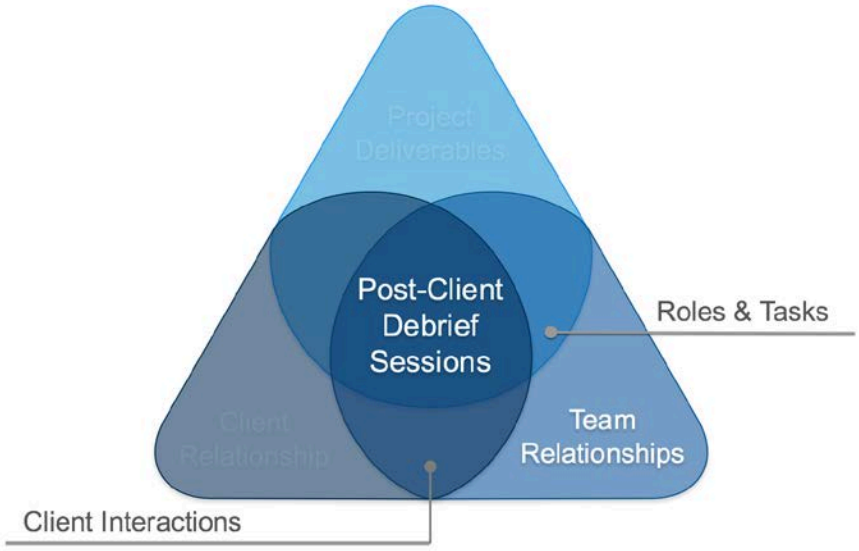

Figure 19: Mentoring learner-management of the team relationships.

Amidst the three faculty mentors, there were some common strategies used to provide this support. They appear as warranted assertions in the first column of Table 6 below. Each assertion is organized within the intersection of the team relationships with the project and the client, some contending more with the client interaction, some with the roles and tasks of each team member and some with both.

Table 6: Warranted assertions based on faculty mentoring the management of the team relationships

Assertion	Team Relationship (Client Interactions, Roles and Tasks)
Mentors facilitate a review of the client meeting by eliciting strengths and weaknesses that occurred, challenging individuals to evaluate their own performance.	Roles and tasks.
Mentors facilitate the debrief in such a way as to catalyze learners to engage with one another, to provoke a building of rapport and to model an environment of critical reflection.	Roles and tasks.
Mentors test learner awareness in a simple exercise that provokes learners to articulate the role and the activities of their fellow team members.	Roles and tasks.
Mentors attempt to fade over the course of the project, spend less time with the team, and unobtrusively observe the activities of the team should the mentor realize that the team has become self-governing.	Roles and tasks.

6.1.5. Strategies at the intersection of all three zones

Facilitating reviews of client meetings, faculty mentors targeted their in-the-moment mentoring in an *ad hoc* way, challenging learners to improve their management of the project deliverables (artifacts), the client and team relationships. As discussed, at times the objective of the strategy was specifically aimed at one or another of these three zones, but more often the mentoring strategy was directed at the intersection of all three. For example, mentoring the team to learn from the management of the client's expectations intersected with learning about how to properly scope the features of the project they promised and dealing with client proposed changes to the design mid-semester that were impossible for the team to deliver. Mentors also prompted learners to draw from group genres that they had learned together in their first semester in order to solve the problem at hand, whether that problem was design-oriented, or had to do with aligning with the client or one another. Lastly, memorable stories were recounted that

provided learners with a professional context of how each mentor had dealt with similar project challenges that surfaced.

At times some faculty mentors approached a mentoring intervention with a specific goal in mind but this goal "changed according to the ebb and flow" (mentor 2) of the moment. All mentors acted as critical-witnesses, in which they facilitated an environment where learners could initiate communication, resolve problems, etc., without much interference or interruption. The observation was usually followed by a critical commentary on what the mentor witnessed. Not interfering or "getting in the way" and permitting learners to solve problems first, reinforces the notion of learner ownership of the project, a characteristic of self-regulatory behavior.

Instead of 'telling' learners how to manage, faculty mentors elicited propositions from the learner of how they would manage each of the three zones and their intersections (see Figure 16). In so doing they allowed the team many learning opportunities to practice how they would solve specific problems within each zone and to improve what they learned throughout the management of the project pipeline. Faculty mentors tolerated a certain amount of failure or mistake-making throughout the project process, as long as the relationship between the team and the client was never compromised.

Table 7: Warranted assertions based on faculty mentoring the management of the project deliverables, team and client relationships

Assertions	**(Project Deliverables, Team Relationships, Client Relationship)**
Mentors scan the room as he or learners speak, in order to assess where learners are at, if they are present, if they are acknowledging what is being said, agreeing or disagreeing with non-verbal cues.	All
Mentors use the meeting to reflect on professional practice and relate what is happening to the team to what happens in a more real-world scenario.	All.
Mentors recount a story from their professional experience to demonstrate how they solved a particular problem related to managing client, team or project.	All.
Mentors prompt learners to use a specific tool or process that will be beneficial to them in order to manage the project, client or each other.	All.
Mentors observe the failure of a team without interfering, so they can have an experience of what not to do.	Project Deliverable, Client Relationship.

6.2. Affording a self-reflexive process for each faculty mentor

This section addresses one of my secondary research questions: In what ways did the research process support faculty mentors to reflect upon their practice of mentoring? The review of the data collected from faculty mentor interviews revealed a number of recurring themes. These included the importance of process versus outcome, the development of a reflective practice, and faculty mentors constantly balancing their own impulse to regulate learners by 'pulling' back and fading.

In line with Action Research investigations, the research process itself seemed to be more important to each faculty mentor than the actual data collected for research purposes. There was an overall feeling from all faculty mentors that the process was beneficial, at least in terms of understanding what strategies they used and how learners responded to those in the video recordings. It was "eye-opening" (mentor 3), "really helpful" (mentor 2), "very worthwhile" (mentor 3), and "nice to review" (mentor 1), faculty mentors remarked. The process brought attention to their mentoring practice by providing them with a useful discussion where they could articulate why they used the strategies that they did. In observing the videotaped mentoring sessions, faculty mentors were able to "confirm notions [they] might have had" (mentor 1) with strategies that they did not know they had employed. The videotaped sessions provided opportunities for faculty mentors to make explicit what they did, reconsider what they were doing and why. Ehrich, Hansford and Tennant (2004) concluded from a review of the field of mentoring in educational contexts that mentors "consider reflection to be fundamental to the overall development of an educator" (p. 532). One MDM faculty mentor commented that reflection on their mentoring practice was important as "it would incite me to think 'I wonder what I could do differently'" (mentor 3)? Articulating why they had chosen to employ a particular strategy also re-affirmed their own mentoring praxis. Mentors appreciated that the research process afforded them the time and space to be able to "talk it through" and wonder "what else could I have tried" (mentor 2)?

As the research methods were focused on collecting data in relation to the strategies that faculty mentors used to support learners, questions during the stimulated recall sessions were not framed in such a way as to investigate their effectiveness. In other words, faculty were never asked to reflect on the strengths and weaknesses of their mentoring approach. Now that we have a catalogue of strategies that faculty mentors can draw upon, one next step could be to determine when they could be used and what we believe about their relative effectiveness at any particular time. This particular study was not focused on measuring effectiveness but future work could ask in what situations are some strategies more effective.

6.2.1. Mentor self-regulation range

What was revealed during cycles of reflection was that that faculty mentors persistently wished to decrease the amount of mentoring they provided learners over time. This was usually spoken of in terms of how much time they would spend with learners as the projects progressed. The amount of time they spent mentoring learners also seemed to be directly associated with how much they felt they had to regulate learners. While all faculty mentors expressed a need to decrease time spent regulating teams towards the last month of each project, there were some differences in whether or how much this happened.

A model that addresses the challenges that the MDM faculty mentors went through is articulated by Vermunt and Vermitten (2004). These researchers described a range of teacher regulation strategies. The range consisted of three phases moving from highly teacher regulated to collaboratively regulated, and finally, to interactions that were predominantly learner-regulated. While measuring the amount of regulation was not the focus of this investigation, interviews with learners revealed a perceived increased capacity to self-regulate. This was the case despite the unexpected concern that one faculty mentor expressed eight weeks in to the project, of needing to increase their regulation of a particular team. Generally, teacher-regulation of the teams decreased,

however, it became evident that some learners required more regulation than others, even as the project progressed.

6.3. Contrasting industry professional pre-research interviews with final learner interviews

6.3.1. Connections with game industry clients

This section will attempt to draw connections between the pre-research interviews conducted with four members of the indie video game industry and learner perceptions expressed during learner interviews. It attempts to answer the question: What characteristics of self-regulatory behavior did faculty mentor that align with the expectations that employers have of new recruits in the game industry?

The always-learning employee

When asked what competencies they regarded as essential to succeeding in the video game industry, one member of the game industry interviewed responded in the following manner:

> Go into it hungry for learning. Be valuable. But the best way to be valuable is to learn what the guy next door learns and also learn what this person over here learns and also identify that someone needs to do that. So becoming that employee that's willing to go I'll do it, I'll try it, look over there, how do I do that? That's a valuable employee because things shift, you're working in a shifting environment, things are always shifting. And the person who has multiple skills and that hunger for learning, that's going to get noticed (interviewee 2).

The idea of ongoing learning and being open to learning multiple skills in a rapidly changing video-game industry is a compelling insight. One dominant theme that I observed from discussions with learners during their interviews was the importance of continual learning. Learners were always learning from one another. One learner went as far as to assert that their team "learned the most that even though the project may not be

that appealing to the team you have to have the energy up and you can always get good learning from any kind of project" (learner 4). Another learner described the entire process as one of incremental learning.

> I know I learned something. At first we were unsure. Incrementally it went better. We got more confident going into client meetings knowing what we were doing and what we were asking. That's kind of how I felt I learned or improved, by doing it again and feeling the difference before and after (learner 7).

Many learners touched on the importance of being adaptable to "whatever the project becomes" (learner 13). One learner revealed their team's initial surprise, resistance then gradual acceptance of the changes to their project requirements.

> There was a tricky meeting at half term that was a big big pivot. We were panicking. What was going on? We were kind of angry. The briefing kind of summarized what the project could be and how we could adapt to the changes so we accepted and went with it (learner 2).

The ability to adapt was not limited to their acceptance of changes to the project. One learner commented on their transformation when it came to becoming more open to the offers made by other team members.

> I'm very direct. In this project I was forcing myself not to be direct or saying things like 'What you're saying it doesn't make sense'. And I think I shifted to understanding that people we're all different and everyone has a different way to solving things and even though your way is not the best way to solve it, and I know that, we can still go with your way. And by doing your way we can all find out if it's not the best way we can do it some other way. But before that I was always thinking you're wrong and I'm right or you're wrong and there should be a different way to do it and I know that this is not the way and I would just stop everything (learner 3).

There exists a compelling connection between the self-regulating learner and the expectation of the industry professional for a self-regulating employee. It is an insight that can add weight to the impulse that faculty mentors have at the MDM Program to mentor self-regulatory behaviors.

The importance of productive failure

By far the most common theme in all interviews with game industry clients was that they wanted their new recruits to take risks, 'fail' and learn from that failure. One interviewee was more specific in highlighting that learning through failure was incredibly important for their entire organization.

> We love that. Great fail. What we'd rather you didn't do is fail the same way twice because that's not so good. Oh that didn't work, let's try something different rather than oh that didn't work let's do that again. That's what we're working for. People who can take the initiative and courage to tackle problems, and courage to notice that they've failed and appreciate that they then have the insight to say 'I think that didn't work but this will. Let's try it' (interviewee 1).

Another industry professional proposed an idealized learning environment that mirrored the existing one at the MDM Program— an environment where learning from failure is facilitated consciously. "Putting people in environments where they can start feeling comfortable failing, where they can get a chance to analyze what they've done that has caused that failing and see that that's really important in a setting" (interviewee 3). Failing in an "as-close-to-the-real-thing as possible" (interviewee 3) and providing learners with real-world projects was deemed important by all pre-research participants as a way to prepare learners for their transition into the video game industry. With "true team projects, true deliverables, true milestone schedules, that is very likely to accelerate that person's uptake once they're in a true work environment" (interviewee 3).

I've already discussed that MDM faculty mentors act as critical witnesses, consciously allowing learners to fail first, then reflect with them afterwards. What is the learner perception of productive failure? The opinion is best told through the learner's own voice— through their own MDM PjBL war story.

> I made a mistake. I sent our client the folder with source files because it was in our project charter, but just before that the client said the game was ours. So the faculty said why would you do that? 'Why would you send it if your

> client just gave you the IP (intellectual property)? You just gave away a million dollars'. And that was hard on me. I'm a manager and I let people down. I know this is a safe environment and controlled environment but now after this experience I would consider it two times before I make a call like that (learner 9).

That the MDM Program allows learners an opportunity to fail 'safely' is an important characteristic of the project courses, which afford the advantage of productive failure put forth by members of the video game industry. The role of the faculty mentor to facilitate reflection-on-failure and Socratically question learners how they would avoid failure in future scenarios, is of critical importance.

6.4. A model of mentoring in adult-driven PjBL environments

Inspired by observing cycles of mentoring that each faculty mentor articulated, I have generated a model to reflect the process. My intention is that this model could be applied to project environments where learners are mentored to collaborate with real-world clients on the co-construction of digital media artifacts. The model suggests the flow of mentoring in PjBL environments similar to the MDM Program's, through three different stages that support the learning that takes place when teams of learners manage all aspects of a real-world project.

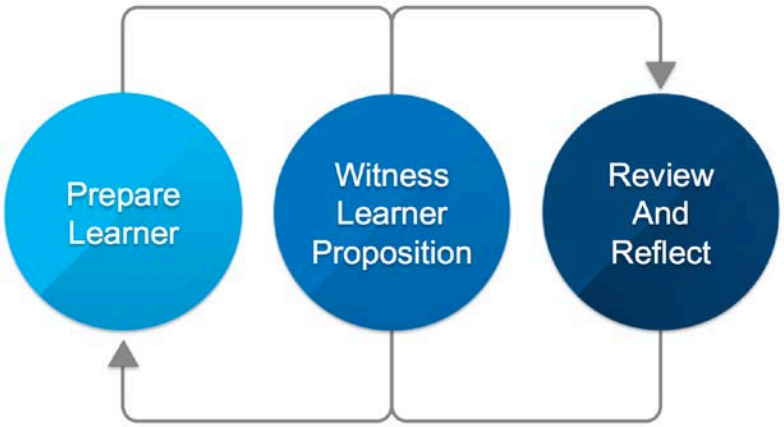

Figure 20: An iterative model of faculty mentoring stages on real-world projects.

The first stage proposes that faculty mentors first prepare learners with the tools and strategies they need in order to succeed on a project course. The more learners prepare with guidance from the faculty mentor, the more successful the outcomes of their propositions to clients will be. The strategies applied by faculty mentors include supporting learner-developed heuristics, increasing professionalism and performance. This stage is by far the most regulated by the faculty mentor. In other words, at first, learners need to be regulated to regulate themselves. While one learner stated "a lot of what we did was based on pitches, how we would pitch things to the client" (learner 12), another was more direct claiming that "even though we had a simple meeting with the client, he was always telling us to prepare, any type of communication. He would always advise for us to be the ones that guide the project" (learner 4). The last point is crucial in understanding that faculty mentors are motivated to prepare learners to take ownership of all aspects of the project, including the management of the client. At the MDM Program, traditionally this preparatory stage occurs during the first semester in the program.

The second stage transforms the faculty mentor into a quiet witness. Here, the faculty mentor quietly observes the results of the earlier stage of preparation, each time managing that delicate balance between allowing learners to fail and regulating the team

when necessary. Acting as a witness, faculty mentors allow learners to make their own mistakes and learn from the consequences of their own actions. As one learner perceived "it's interesting because I always— and we know how we act in front of clients— we are aware of that, but even though we know that sometimes, we just need someone to tell us 'You're doing this or that', even though you know" (learner 15).

In the third stage, faculty mentors summon their critical-self and facilitate a review of learner interactions with the client, the project and/or one another, so that the team can reflect, refine and improve those interactions. In the reflection stage, faculty mentors are also able to see the results of their mentoring and together with learners reflect upon that mentoring and refine it. The process is repeated and refined, with the ideal goal that the faculty mentor fades more and more each subsequent mentoring session. Making this process more transparent may support learners in managing the entire three- stage process. The observation was reinforced when one learner asserted that "his [faculty mentor's] purpose is to make us aware of the decisions we are making and why we are making them and learn to plan" (learner 16).

6.4.1. Teacher regulation

The ideal goal of the entire iterative process is to reduce the amount of mentor regulation over time and provide learners with opportunities to increase their own self-regulation. Each bubble (1st, 2nd, 3rd Cycle) in the graphic representation below represents one cycle of the iterative model of mentoring.

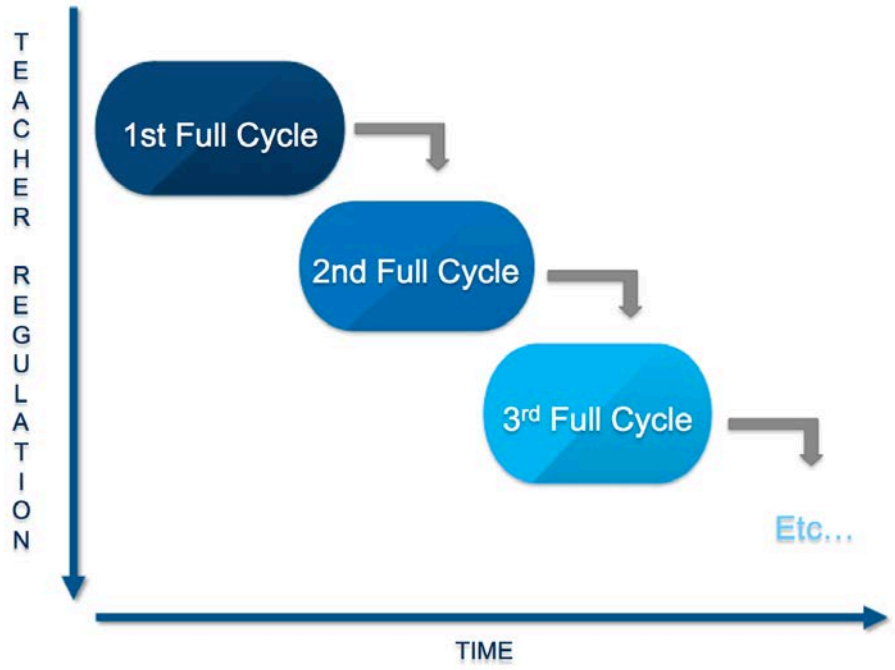

Figure 21: Decreasing teacher regulation over time.

The reality, however, as revealed in the mentoring sessions is that the decrease of teacher regulation and the increase of learner self-regulation are dependent on the team and the faculty mentor and how the project unfolds. Generally, while mentor regulation of the entire team tended to fade towards the end of a project, there were unanticipated moments of increased mentor regulation. One faculty going as far as to express surprise "because a lot of the advice I gave them including pointers after the last two meetings seemed to be ignored quite a bit" (mentor 1). For one team, the faculty mentor maintained a well-balanced presence indicating a more moderate amount of regulation. "He was not either too much with us or too little. It was a good balance. At the beginning he stayed longer with us. The first month every day and eventually less and less time with us" (learner 15).

Overall, team regulation provided by the faculty mentor generally decreased over time, but how much it decreased also depended upon the capacity of individual learners on each team to self-regulate. Learner interviews attested to this factor, with one learner

expressing that the faculty mentor “interacted differently with different people” (learner 9) in this regard. And further, another learner on the same team observed that “the team would turn to the advisor to verify or to affirm. This is what we agree as a team. Let’s ask [our faculty mentor]” (learner 11). Yet learners also regulated one another and while some requested affirmation, the same learner reminded his team that in the end it was “our decision” (learner 11).

Despite what the faculty’s experiences of mentoring self-regulation to teams of learners were, sixteen of the eighteen learners dispersed across three teams expressed increased ownership and management of the project. Some of those learners went so far as to comment on fellow team members expressing that “I felt change in her also” (learner 12). Yet another learner demonstrated self-initiative beyond her defined role and responsibilities mentioning “at times I wasn’t really happy with the presentation so I wrote the script for the entire final presentation” (learner 6).

6.5. Limitations of this research and Future directions

6.5.1. Limitations of this research

I consider this research to be a preliminary action research process. The stated purpose was to document mentoring strategies (Figure 11) so as to better understand mentoring practice and this was accomplished. The study, however, was not focused on measuring the effectiveness of the faculty’s mentoring strategies. During the stimulated recall sessions faculty mentors were never asked to assess their mentoring nor were there any commitments made to change or improve the strategies they did use. In some ways, this may have limited the purpose of their reflection. Even though the management of the client was key, I was not able to measure the impact that managing the client had on the self-regulatory behavior of the learners.

Complementary to this was not implementing an instrument to measure changes in self-regulation of learners. The resistance on the part of faculty mentors to use an instrument that I developed during the pilot study speaks to the challenge of empirically measuring where individual learners are at in terms of any kind of scale of self-regulatory behaviors. The mentoring was for the most part directed at the group, rather than individual members. Measuring the self-regulation of the group was also a challenge, since different learners expressed different degrees of self-regulation throughout the semester. Self-regulatory behaviors were also inconsistent. There was never a strong sense of definitive improvement from one mentoring session to another. Only in final interviews with learners do we learn that indeed, some changes in self-regulatory behavior were perceived by them. In future investigations, however, tracking mentor regulation would be more practical and useful if those perceptions were triangulated with learner perceptions of their own self-regulatory behaviors following a mentoring interventions.

6.5.2. Future Directions

The ongoing integration of an Action Research process within the MDM Program's PjBL environment is recommended. My understanding of Action Research is that there is no hard stop to the process. I acknowledge that it was important for the scope of this study to establish an ending point but I would like to continue to improve upon the process as I am attracted to Action Research's potential to change practice.

During final interviews all three faculty mentors expressed a desire to know what strategies the other faculty mentors were using. One specifically noted "I should get more involved with the faculty to understand what tools I could get from them. I have my own toolbox but then the process has elicited me thinking: 'How do I expand my toolbox" (mentor 3)?

Revised methods could include faculty mentors observing each other's recorded mentoring sessions simultaneously to stimulate dialogue, and 'expand their toolbox' of

strategies. In this way, more experienced faculty mentors would provide insights to the less experienced ones. Less experienced faculty mentors could also propose ideas that were not considered before. Nurturing a process of stimulated reflection like this could be a valuable step towards creating a community of practice of faculty mentors and the development of a common vocabulary and methodology of mentoring within the MDM Program's PjBL environment.

Another compelling investigation worth considering is how learners would regulate each other on project courses at the MDM Program. How would regulating each other affect their own self-regulating behaviors? While characteristics of self-regulation on project courses at the MDM Program are apparent in many of the final interviews with learners, data also provided evidence of a strong impulse for learners to manage and learn from one another. This is partly due to faculty mentors facilitating a learning environment akin to what Nielsen and Kvale (1997) refer to as "decentered learning." The intention of MDM faculty mentors was not to create a dependency, but instead to 'wean' learners off of needing them over time. In this way faculty mentors de-emphasized a "person-centered approach to apprenticeship learning, where the focus is centered around the relationship between the master and his apprentice (Polanyi, 1958; Schön, 1987)" (p. 241). Faculty mentors at the MDM Program facilitated a more "decentered approach" directing learners to learn from one another and their clients as representatives of a community of practice.

Final learner interviews indicated that decentered mentoring could also be regarded as a characteristic of dispersed regulation. Learners were "teaching each other all the time" (learner 17). When asked where the source of learning took place one learner commented "it depends what you mean by learning" (learner 14). Echoing Lave and Wenger's (1991) characteristics of a community of practice, for this particular learner, "learning processes [were] intrinsically social and collective phenomena" (Teece, Rumelt, Dosi & Winter, 1994, p. 14). When it came to describing what and whom they learned from, the same learner remarked that "in terms of knowledge of games it was

[student name]. In terms of what they were useful at, [another student] was good about colour composition and illustration style. [They] had [their] own rules which was useful in designing the look of the whole game, characters, and the world" (learner 14).

Future research of the decentered mentoring that the MDM's PjBL environment affords could investigate how learners are regulated by one another, faculty mentors and clients. In this way the investigation itself would come to better define the MDM Program's own signature pedagogy; those pedagogies that "organize the fundamental ways in which future practitioners are educated for their new professions" (Shulman, 2005, p. 52).

To support the practice of mentoring during the MDM Program's project courses, investigations need to consider both the faculty mentor and the learner experience. Although this particular investigation focused on the faculty mentor's experiences, deepening our simultaneous understanding of how learners self-regulate, may provide more insights into how to support their ownership of the project, the client and one another.

By virtue of the specific PjBL curriculum at the MDM Program, investigating my own post-secondary teaching and learning environment adds to the literature of PjBL research. The most unique and informative layer of complication is that the research integrated representatives of a community of practice (i.e. a client) within the digital media industry in Vancouver. How faculty mentored learners was to a great degree informed by persistent learner interactions with their project's clients. In addition, since the MDM Program presents itself as an educational bridge between higher education and the digital media industry, learners come into the program with an expectation that the program itself will prepare them more than other programs to transition into those industries.

This factor alone differentiates my research from non-adult PjBL research as it suggests different motivations, engagement, and self-managing— all characteristics of self-regulatory behavior— dependent on the maturity of adult cognitive processes. The difference between adult and non-adult research is supported by Vermunt and Vermetten (2004) who in their investigation of learning patterns of a wide range of learners (primary, secondary and undergraduate) assert that "qualitatively different learning patterns [can be identified] and that some patterns are better than others in view of the knowledge they lead to, and in view of the preparation for lifelong learning competence" (p. 381). For the researcher, "assessing the learning patterns of their own student population may give a teacher, a faculty, or an institution a view of the dominant student learning patterns." (p. 381). That these learning patterns are both intrinsically and extrinsically motivated, in part informs the mentoring strategies that faculty mentors use at the MDM Program. Vermunt and Vermetten (2004) also assert that "young pupils do not discern as many learning strategies, conceptions, and orientations as students in higher education usually do" (p. 370). While most of the literature of PjBL makes mention of self-regulation as a common learning outcome, more research on both self-regulation and how actors regulate one another in PjBL environments would be advantageous.

Logically, it would follow that any inference drawn from research in adult PjBL environments could not subscribe to the conditions of another. However, the drive to construct empirical assertions whatever the reason, seems to outweigh the reasoning of why it is important. How can we reconcile those assertions drawn from the ill-structured nature of PjBL where "unstated goals", multiple evaluation criteria, multiple solution paths and "no general rules or principles for describing or predicting the outcomes of most cases" (Jonassen, 1999, p. 217) dominate? While the question can easily be generated for much qualitative research, it is a particularly contentious one for research conducted in PjBL that every researcher needs to address.

If my research values remain true to the more substantive research on constructivist, social constructivist and situated learning environments and their generalizations, then it is stronger to support my claim that research conducted within project-based learning environments is context specific. Although I may yield some generalizations based on the findings that emerge, they may only serve research that is conducted under the same conditions. This is certainly the argument that Stake (1983) and others make with the notion of naturalistic generalizations.

My hope for the near future is to plan and conduct a more extensive longitudinal study of mentoring at the MDM Program. While improving the practice of mentoring was not an outcome of this Action Research process, proposing the question to mentors at the beginning of a future research cycle: “How can this research process improve our practice of mentoring?”, might provoke us as a community of practice to be more strategic in our approach. This might open the door for mentors to try out mentoring strategies that other mentors are using, or to experiment with new ones they have not yet tried.

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Appendix A: Agile Project Management

Reasons for using Agile at the MDM Program

The changing nature of the requirements of projects is an expected characteristic of project courses at the MDM Program, particularly because of the regular feedback from clients that learners are tasked to integrate into subsequent iterations of their design. The management process that is used to facilitate the co-construction of digital artifacts cyclically is called Agile. As Agile is a dominant methodology used in the video game industry, learning Agile for project management prepares learners for the practices of that community. Key aspects of an Agile methodology are also aligned with some of the primary characteristics of the MDM Program's PjBL environment. Moderate to extreme changes can occur weekly or bi-monthly after clients provide feedback to prototypes that learners present. Changing requirements can occur often and Agile is equipped to deal with them. Learners often demonstrate an inability to contend with changes to the design, motivating faculty mentors to reinforce principles of Agile throughout this challenging process.

Structuring short cycles of prototypical development using Agile

Agile project management methodologies contend with changing requirements inherent in software development. They are often used to manage unpredictable cycles of software development, identified by short time-periods (sprints) where a team co-constructs specific features that contribute to an overall product's design. At the completion of each short cycle of production or sprint, users can usually interact in some way with a representation of the final product. These prototypes provide all stakeholders with an idea of the functionality that will be integrated within the final product. At the end of each sprint a review or retrospective is conducted that informs the continued direction of the project's development. During a retrospective, several realizations can materialize. In some cases, the working prototype may reveal that the original idea of a

game the game mechanic, or the gameplay itself has potential and should be further developed. In other situations, the working prototype may reveal that the idea wasn't that good to begin with and alterations need to be made. The state of the prototype at the end of any particular sprint informs the client, team of learners and faculty as to its continued potential.

User-centered design and Agile

Through a user-centered approach teams identify certain features that the product will consist of over a specified period of time. Features tend to be generated from what are called user stories. User stories are organized in a specific format as to identify a potential user and their needs. For example, *as an* eighteen year-old, *I want* to post pictures of my friends *so I can* show the world how popular I am. Features that are derived from user stories are then deconstructed into smaller inter-dependent tasks that team members must co-construct together.

Managing of unforeseen developments

Inherent in Agile processes is its ability to contend with the unexpected and provides tools for teams to adapt and manage change. Often, unforeseen tasks present themselves, in part because initial requirements may not be completely defined. The team may also be co-constructing a new interactive product that they may not be completely sure how to implement. In addition, the completion of existing tasks may have taken more time than initially predicted. Using an Agile approach, the solution to these anticipated design problems is a growing list called a backlog. Tasks that inevitably end up in the backlog are prioritized in subsequent sprints in order to ensure that they are completed.

User testing in Agile environments

At the end of each Agile sprint, whatever prototypical state the product is in, one or more aspects of it should be able to be tested. Depending on the size of the team and company, tests to the design are usually organized. A hypothesis is clearly stated by the development team, then the interactive product is tested. While the product is being tested, the development team take notes through observation or ask targeted questions of the users and these can inform future iterations of the prototype.

Team alignment in Agile

Because of the persistently changing nature of product design in Agile, there is a necessity for teams to remain aligned. This is achieved through the implementation of a daily Scrum. Scrums are structured in such a way as to allow team members to ‘catch up’ with one another on their previous activities, inform one another what they are currently working on, and receive support for a distributed task that they are working on. Agile is most useful to align members of a team whose work is inter-dependent. Through persistent communication and re-organization, team members are able to have a sense of the big picture in terms of where they are at in the development of the product, and who is doing what. Team members learn to rely on one another to complete tasks that combine together to implement a feature. For example, in order for the team to create a prototype of one level of a side-scrolling video game, an overall design has to be in place, art assets for character, UI and environment need to be developed and these have to interact with each other within a software development environment. Without art, there can only exist a low fidelity prototype that demonstrates a game mechanic. Without programming, even the highest fidelity 3D model cannot be placed in an environment where a user can control it. Without a design, the user will have no idea of the point of the game.

Cyclic alignment with Action Research

The Action Research methodology applied in this investigation was also aligned with an Agile project management process. Both were cyclic in nature, and the transparent or ‘flat’ ecosystem that each process engendered, provoked increased ‘ownership’ of the project by individual team members.

Primary resource

While Agile is used differently across projects, teams and organizations, there are some common principles, that I have often referred to through the primary resource below.

http://www.agilemanifesto.org/

Appendix B: Group genres aligned with user-centered design

The tools and processes assimilated by learners in their first semester become reinvented in the context of solving design problems during their second semester project course. Referencing Cook and Brown (1999), these maps, tools and ways-of-knowing when applied in context transform into group genres. The learners work together to modify and refine them in their project rooms to solve in-the-moment challenges. As discussed in the paper these group genres become used to manage the project, the client and the team relationships. The tools below represent a short number that are taught in the first semester. Examples of how they could transform into group genres are also provided after their short description.

User-centered design

User-centered design at the MDM Program is a process of developing interactive digital media products for potential customers, or solving human-centric problems through an interactive digital media product. In their first semester of classes students at the MDM Program all learn the same visual maps, processes and tools in order to support their co-construction of user-centered interactive projects. Some of the visual maps and processes referenced by learners during the investigation included OARRs, Rules of Play, Personas, Bullseye, KFC (Keep, fix, change), and Day in the Life. I will provide a short description of how each was used by teams to solve design-oriented problems.

OARRs: Managing client meetings

The Objective, Agenda, Rules and Roles map was commonly used by learners during client meetings. Learners communicated the objective of the meeting with the client, set an agenda, assigned roles to one another and developed rules they could all agree upon. Objectives and agendas were generally made transparent to the client, whereas roles and rules were agreed upon by the team learners prior to starting the

meeting. For example, a common objective stated in initial meetings with clients was that the learners wanted to arrive at an agreement with the client as to what interactive digital media artifact they could deliver within a 13-week timeline. Agendas detailed action items that each meeting would address. The roles mainly had to do with learners distributing the responsibilities necessary in the meeting (note taker, principal communicator, time-keeper, etc...). Rules of the meeting were meant to keep learners aligned. Common rules for every meeting included learners being aligned on what they would say to the client prior to the meeting, that no one would interrupt, challenge or question their team members in front of the client, and that ideas not previously discussed with each other prior to the meeting wouldn't be proposed to the client.

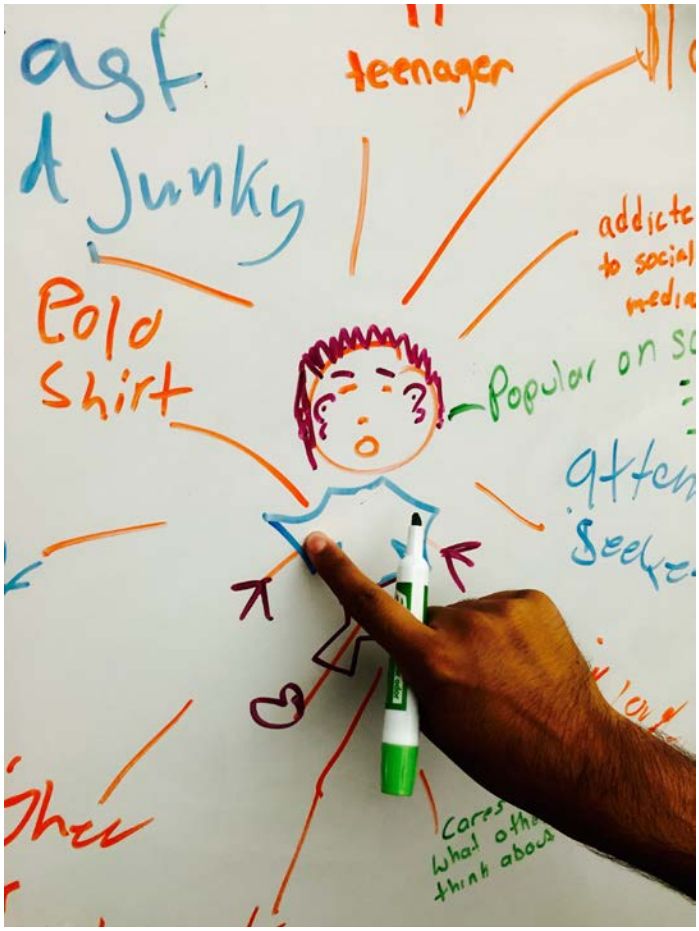
Rules of Play: Managing team relationships

In the collaborative MDM Program learning environment learners need to remain aligned on what they decide they are going to co-construct, how they manage the client relationship and how they manage the project and one another. To remain aligned throughout their project course, learners generated a set of agreements that they could all agree upon and adhere to. This was usually achieved at the beginning of the project cycle, with the group drawing up a 'Rules of Play' list. Rules of Play were generative. That is, not every rule could be proposed at the beginning of the project cycle, without knowing what rules needed to be elaborated on or added through the action of collaborating together. The challenging aspect of the Rules of Play genre was for teams of learners to constantly update them as the project progressed. Setting up team rules challenged learners to make their individual tacit assumptions of one another, explicit. In reference to Cook and Brown (1999) Rules of Play transformed into a group genre, and individual rules also transformed as tacit group knowledge. In the context of their project rooms, learners also elaborated on the Rules of Play genre by adding consequences. One example that occurred frequently was when learners were unable to commit to starting at the designated time they had all agreed upon for their Scrum. One particular team

developed a consequence to not adhering to certain rules, such as contributing to team snacks.

Personas and Day-in-the-life: Managing user-centered product design

Personas and the Day in the Life tools are both visual maps that attempt to project who the potential customers or users of the interactive digital media product might be, and how they might interact with the product during a 'typical' day in their lives. Through a Persona map learners attempted to understand the potential needs of their customers.



Visual Map 1: Example of a Persona map

A day in the life map attempted to depict instances in a potential user or customer's day where they might interact with the digital media product that learners were co-constructing.

Visual Map 2: Example of a Day in the Life map of a potential Instagram user

Prioritizing user-centered design features: the Bullseye map

A Bullseye map is an effective way to prioritize any idea or feature of a prototype in order to help the team and client focus on what is most important to the user. Bullseye maps were usually visualized with three concentric circles much like a standard dart board. Ideas or features were placed on individual sticky notes and the greater the priority of that feature being co-constructed the more its propensity towards being placed at the center of the bullseye. Those features that were less important for the client and team of learners were placed on the outer rings. Typical questions teams of learners asked to help guide how they prioritized features included:

- What were the most important features they needed to prioritize for this prototype?
- Which game ideas could be pitched to our client?

Visual Map 3: Example of a Bullseye prioritization map

Appendix C: Examples of Reported Transcriptions to Mentors

Mentoring Strategies: Session 1, Faculty 1 (January 19th, 2015)

Dear (faculty mentor #1)

Below are my notes of the methods that you used and that we talked about during our first stimulated recall session. I also note that I've categorized the observed methods as strategies since there was intent behind their use. This approach is aligned with your own thoughts that I conclude this document with.

Observed interactions (as strategies): Total of seven aligned strategies

Feedback

The first and probably simplest strategy that you used was to give them feedback on specific situations and guide them as to how to improve. In this case pitching their ideas. We observed this together during the playback of the video-recorded mentoring session. "*The scope of your pitches were too big. He did not hear the core idea. You should be able to turn around and immediately tell him what the game's about. One of the things you can do is practice that.*".

Reliance on previously learned tools

We observed the use of at least two previously learned tools that you had taught learners in the previous semester.

The first was reminding the team of the tool you introduced last semester (Keep Fix Change) and how it could be applied in another context. In the previous semester, the

KFC tool was used to guide learners in a reflection of what features of a product they should keep, fix or change. I noticed that you started the debrief of the client meeting with a reflection. You mentioned during the stimulated recall session how you mentor the team to use the KFC tool as part of that reflection. *"We actually start with what went well., what didn't work, what do we need to change when we have a similar meeting."* Providing them with a simple framework or lens through which to review their performance at the meeting was important to you. It would be interesting to see if they pick up on and initiate that framework in future debriefs. (*note to reader: learners were observed to begin each subsequent client debrief with the same structured reflection*).

Graphic recording a meeting was another tool that we observed being used by you and the team during the video-recorded session. You mentioned that you asked a visiting graphic recorder '*to write things she specifically heard from the students so that during the debrief session they could observe 'an annotated transcript of their pitch*'. In your words: '*They all gravitated to (graphic recorder's name) graphics and I don't' think we would have had a session without the board there. They had time to take in the entire board. I reminded them that the graphic recorded was someone that had no briefing on what they were going to pitch. She knew nothing'.*

Timing of debrief

We also discussed the importance of the timing of the debrief. *The "important thing was catching it immediately after the moment because they're still doing a personal reflection… because they are really wondering how they did or whether or not something they did, didn't happen, or whether they should be cheering that their idea or their comment in the meeting was the one that won the day."* To further emphasize the importance of debriefing with the team right away, you also offered some reasoning as to what can typically happen if the debrief does not occur right away. "*That's when they are*

seeking confirmation the most. If you let them stew on it then they go with their assumptions and draw incorrect conclusions."

Managing Client

We discussed the importance of mentoring the team to manage the client. You provided a simple example based on what transpired in the mentoring session, drawing the team's attention to the client's aesthetic. This strategy was multi-layered really. You started by reminding the learners of the client's aesthetic and the company's aesthetic for game creation (a public document you linked them to). After you mentioned the client's aesthetic you repeated what the client had said during the meeting. This challenged the learner's to align with the client's expectations as well as providing them with a key ingredient towards designing games. "*Keep it simple. Think about your childhood experiences."* That strategy also initiated a learner to admit that they were not considering simplicity in their design process. *"I think it's a mistake that is useful to us and now we know"*. The reflection and realization may propel them to change their approach the next time.

Memorable (war) stories

Further to this you also told a war story of a previous MDM client, so you had the advantage of sharing an experience with the team that could be immediately relevant. Moreso in that the client had the same cultural background and approach to designing games. "*It was a big thing with (name) from (company name). He would obsess with what he would call the core loop. I need to be able to understand how I start, and how I win the game. So when he (new client) refers to hide and seek: 'I hide eyes. I go find you. I win'. All the other things you're thinking of. It doesn't matter. I could be a polar bear and it wouldn't matter. So you got to boil it down to basic core mechanic. That's why every time you hear him say Game Design, that's what he's saying. He uses this in*

limited English to say 'this is the meat of your idea'. The advice re: core loop that you provided through reflecting on a previous experience happens to also be an essential aspect of game design that is commonly shared with many game studios small and large (see Rules of Play, Salen and Zimmerman).

Socratic Questioning (silence)

We also observed your use of silence or waiting for learner response as a strategy to facilitate them having conversations with one another. I thought of this when you said in your recorded session with the learners, *"the next thing you're going to need to understand is his language. Is he wanting a prototype…..*?" What's interesting is that one learner jumped in and asked the next question and you left enough space for someone else on the team to respond. In this case (name of learner), because she was confident with the answer. Your response to me during the stimulated recall session was that **"***they(learners) also need to start answering these things for themselves***".**

Humour

Humour was often used as a strategy to soften the at times intense self-criticism that learners go through. This was observed in the case of (name of learner) whose idea, you told me, was rejected by the client. During the video-recorded session she was observed to be quiet and pensive. After the recorded session you mentioned that you spoke with her and the team. *"So she felt ok and I teased her about it and joked with her and they got to laughing eventually"*. Although humour may be second nature for you, in this case we observed how it was used strategically to deflate the tension and self-criticism, allowing learners to become more detached from the situation and not take it too personally.

Conclusions

As a final comment I wanted to conclude with our aligned opinions after reviewing the video-recorded session, that critically reviewing the debriefs of client meetings in our stimulated recall sessions can provide us with a lot to think about. Within a relatively short period of time (30 minutes of a recorded session) you applied seven complementary and layered strategies to mentor the team of learners.

And in your last words of the stimulated recall session:

"*Every time I'm in the room now it's in referral to the last client meeting. It's one thing to remind them about the brief and project rules, but once they have the client and that context it's a strategy session. It was all about how they would have to go back to their client in the next meeting, and have a new tool for negotiation of their scope. So, bringing it back to 'this is how you're going to get one more step ahead in winning over your client.' So it is all strategy sessions from here on out.*"

Mentoring Strategies: Session 3, Faculty 2 (March 26th, 2016)

Dear (faculty mentor #2),

Below are my notes of the strategies that you used and that we talked about during our third stimulated recall session.

Observed interactions (as strategies): Total of seven aligned strategies

Socratic Questioning (to facilitate reflection)

We observed your use of strategies that you had used before such as Socratic questioning in order to test the self-awareness of the team regarding how they organized and performed during their client meeting. The difference, however was in this case the questions were targeted in such a way as to provoke them to reflect on their inability to implement previously learned tools. For example, implementing organizational processes (such as an agenda) that you had suggested previously (in first session for ex.) and that learners had already been taught to use in previous semesters.

(mentor) on tape: How do you think the meeting went? (with client)

(learner 1) on tape: it was disorganized

(mentor) on tape: So why was it disorganized? You knew the meeting was today at 10:00 a.m.

(various learners): We were unprepared. (general agreement).

(mentor): So there was no agenda. Nobody was tasked with hosting the meeting. The ipod wasn't charged.

In this case you used socratic questioning to facilitate a deeper understanding of why the meeting was not a success. Moreso, the reflection provoked learners to realize

that they had repeated the same mistake in previous meetings. An agenda, for example, was a specific tool that the team had decided they would use after their first mentoring session.

Reliance (regular) on previously learned tools: group genres

You also emphasized the importance of reusing specific tools like an agenda to support their short term meeting goals. The reuse of a specific tool (agenda) was deemed necessary as you mentioned that learners have ***'****all have these tools in their toolbox but they're all doing a variety of other things. If no one organizes this meeting for them then it probably won't happen'*.

Productive Failure

Your guidance of the team to deeply question why their meeting was not successful, allowed them go deeper into the root of the problem as to why they experienced that 'failure'. This persistent probing was evidenced by you simply asking how the meeting went and allowing the learners to tell you why "it was disorganized". Learners needed to reflect in order to understand their experience of failure and therefore be able to know what they don't want or where they don't want meetings to "end up" in the future. "*I think that also in order for them to improve they have to have something to contrast it. So they know this was a bad meeting. Maybe that will stimulate them in their next meeting to be more on the ball. Failure is a learning opportunity. This one they failed so maybe they'll use that as an opportunity to pull their socks up."* We discussed that we would categorize this strategy as an example of productive failure, and reflects one of the essential components of project-based learning environment. We also discussed that a greater definition of the strategy was demonstrated in the way you drew learner's attention to the failed part of the process (one they all felt) and in a reflection allow the solution to emerge from the learners rather than simply proposing one for them.

Productive Failure & Socratic Questioning combined

I also observed that you let the failure occur (during the team's meeting with the client), because without it learner performance may have been more performative and less embodied. You asked, *"if I was to recognize an issue and before the meeting said ok we're going to have a preparation meeting. Make sure you guys are all dialled in, is then there performance in the meeting, real performance? Or is it coached performance? And if I keep doing that, the first time I don't do that, will they do it? Or because they've had that support and prop they won't do it because somebody didn't do it for them?"* Your approach also demonstrated socratic questioning in that you 'held back' from providing learners with all the answers.

Appendix D: Grouping and categorization of quotes extracted from nine stimulated recall sessions

The table below consists of 60 extracted quotes from the stimulated recall sessions and the video recorded mentoring sessions, that led me to organize them under common categories. Column 1 explains the category. Column 2 provides the quote as well as its interpretation. Column 3 shows whether the quote came from the stimulated recall session or the video recorded one. The quotes came from 9 different transcribed sessions with all 3 faculty mentors. In addition to the quote I've included its interpretation in order to provide a greater context for its reasoning.

Table D1: Grouping and categorization of quotes extracted from nine stimulated recall sessions

Strategy Categorization	**Extracted Quotes and Interpretation that led to grouping the quote under a specific category**	**Source**
While all mentoring strategies could be interpreted as providing ***feedback*** to learners, these quotes in particular demonstrate direct feedback that the mentors provide to learners based on their performance at a client meeting.	Mentor 1: Before we went online [for client meeting] I was recommending to take breaths between sentences. She didn't on a complex idea. That to me was why he [client] asked for a 2nd explanation. **Interpretation**: The primary strategy was to provide feedback to the learner as to why her idea wasn't received well, even though it could also be interpreted as feedback directed at managing the client's expectations.	Stimulated Recall
	Mentor 1: So what I needed to reinforce was some of the things that went well so that when they realized they weren't pitching core ideas; they were still ok with themselves.	Stimulated Recall

Strategy Categorization	Extracted Quotes and Interpretation that led to grouping the quote under a specific category	Source
	Interpretation: The strategy is to empower the learners by providing direct feedback of the positive outcomes of the client meeting.	
	Mentor 1: The scope of your pitches were too big. He did not hear the core idea. You should be able to turn around and immediately tell him what the game's about. One of the things you can do is practice that. **Interpretation**: The feedback provided is to encourage learners to practice their pitches more prior to presenting them to the client.	Video Recorded Session
	Mentor 2: What I'm trying to get out of them is how did they conduct the meeting? Were they effective in getting in their communications? Did they. Were they able to either receive what they were looking for or push the meeting enough to get what they needed out of the meeting. **Interpretation**: Although the strategy the mentor used could be interpreted as Socratic questioning, he eventually did provide them feedback on the importance of controlling the flow of a meeting with a client.	Stimulated Recall
	Mentor 3 [on the importance of a 360 review): I tell them you're sitting beside someone you would expect to know but communication can break down even if you're sitting beside each other. **Interpretation:** The mentor is providing feedback to the learners that directly mentions the importance of conducting a 360 review. In the 360 review learners are given the opportunity to discuss their and their team mate's strengths and weaknesses.	Stimulated Recall
	Mentor 1: What I wanted them to be conscious of is that in their presentation style they could talk less about an idea that's being prototyped and now focusing on a prototype becoming a product. **Interpretation**: Mentor provided direct feedback based on the client questioning why were they not moving forward with the idea at a higher level of fidelity by now.	Stimulated Recall

Strategy Categorization	Extracted Quotes and Interpretation that led to grouping the quote under a specific category	Source
	Mentor 1: Bringing up the practical where they recognize that as stuff that will show up on their task list rather than 'oh we have to rez up now.' For students they are much more conscious of the short term and that was how to bring the idea into a context they could relate to more easily. **Interpretation**: In this example we discussed how the mentor kept rephrasing his feedback in several different ways until learners understood and could relate to the concept.	Stimulated Recall

Quotes here represent the mentor's opinions of the ***timing*** of the retrospective or review of the client meeting in addition to reflection of the team's performance.	Mentor 1: The important thing was catching it immediately after the moment because they're still doing a personal reflection. They are really wondering how they did or whether or not something they did, didn't happen, or whether they should be cheering that their idea or their comment in the meeting was the one that won the day. **Interpretation:** The mentor here is directly commenting on the importance of facilitating a debrief of the client meeting right away.	Stimulated Recall
	Mentor 3: Conducting a 360 in the middle of the term is important. They sit together side by side, yet they can struggle to really know what each other's doing. **Interpretation:** The mentor reflects on the importance of a mid-term alignment of the team, so that each team member is clear on what they and their team mates are contributing to the project.	Stimulated Recall
	Mentor 2: I want them to catalyze their rapport with each other. **Interpretation**: This comment came from the mentor mentioning the importance of being self-reflective about how client meetings were facilitated early on in the process to encourage the team of learners to make reflection a regular part of their process.	Stimulated Recall

Quotes here demonstrated an overall focus on the importance of learners ***managing the client expectations*** of the project including the client's familiar way of doing things.	Mentor 1: There was a clear indicator and admission that she had to hear it 3 times from the client before she decided that it was important. Keep it simple. Think about your childhood experiences. **Interpretation:** The reflection here is that the learner can be observed on the video recording admitting that it took them many times to understand that the client wanted the team to co-construct a game based on childhood experiences. To do so they would need to step into the shoes of a child in order to design for the console and audience that the game was intended for.	Stimulated Recall
	Mentor 1; It was a big thing with [client name] from Bandai. He would obsess with what he would call the core loop. I need to be able to understand how I start, and how I win the game. So when he [new client] refers to hide n seek. I hide eyes. I go find you. I win. All the other things. It doesn't matter. I could be a polar bear and it wouldn't matter. So you gotta boil it down to the basic core mechanic. That's why every time you hear him say Game Design, that's what he's saying. He uses this in limited English to say "this is the meat of your idea". **Interpretation:** The mentor provides learners with direct feedback on interpreting the client's needs as they had difficulty translating the client's aesthetic as a core mechanic of the game they were making. The quote also reveals a group genre that all members of the team learned in a game design course during their previous semester.	Video Recorded Session
	Mentor 1: It was all about how they would have to go back to their client in the next meeting, and have a new tool for negotiation of their scope. So, bringing it back to 'this is how you're going to get one more step ahead in winning over your client.' So it is all strategy sessions from here on out.	Stimulated Recall

	Interpretation: The mentor is reflecting on the purpose of the review meeting where he provided them with a scoping tool to help scope the client's expectations of the project. The tool itself was a known group genre that all learners were familiar with but were unable to draw from in their present situation. At times, mentors remind learners of the tools they have learned and how they can use them in different contexts.	
	Mentor 2: What I'm trying to get out of them is how did they conduct the meeting? Were they effective in getting in their communications? Did they? Were they able to either receive what they were looking for solicit or push the meeting enough to get what they needed out of the meeting. **Interpretation:** The mentor is provoking learners with Socratic questioning to ensure that they understand the importance of planning and managing a client meeting. In so doing, they will be better able to fulfill their own objectives for that meeting.	Stimulated Recall
	Mentor 3: I've also tried to continually tell them that the language they use should match up to the client. I told them you know what, in this industry it's not standardized. There's so many terms for the same thing. When we went to the client meeting we heard the terms they like to use. Use the same term in whatever we're talking about. **Interpretation:** The feedback is directed towards a specific way in which learners can communicate ideas to the client. The mentor is observed on the video recorded session emphasizing the importance of speaking the client's language. This particular strategy was also used by Faculty 3 in a separate session.	Stimulated Recall
	Mentor 3: The client already expressed everything is satisfied. Now what he wants is a presentation to his company most likely of what they've learned? Maybe like a white paper.	Stimulated Recall

	Interpretation: The mentor here is guiding learners as to what they should present in their final presentation to the client. In presenting what they learned, learners will also be able to reflect on their own learning process and share those reflections with the client, the mentor and each other.	
	Mentor 1: I'm thinking of doing a 360 based on 'what did you hear?', 'what did you hear?' and 'what did you hear?'. What did you hear? What does this mean? How do we move forward? It's almost a debrief scrum. **Interpretation**: The mentor was responding to the difficulties that learners sometimes have listening to what a client is asking of them. While there was no recorded follow-up where the mentor put his idea into practice, the important thing was the reflection that this could be a tangible exercise to support learners in the future.	

These quotes represent ***War stories or memorable stories*** that mentors told learners in order to relate to what the team might be struggling with or to relate a part of the production cycle with best practices familiar to the mentor. Many of the quotes from the stimulated recall sessions are a description of why the mentors had told a particular story.	Mentor 1: When we talk about MDM competencies, this whole thing of time management isn't about I can fit my project into my 9 to 5. It's more like I can fit this project into my life. I've never been on a project where I stopped thinking about it because it was Friday afternoon and I've got to do this other thing on Saturday. I don't know if that was something that developed in my character or is it part of my dna? We just know that to be successful in a competitive world you have to stay on top of it. This was the approach at PDI. **Interpretation:** The response was a result of observing learners in the video recorded session create time restrictions to their project when they were unable to scope well in the beginning. Because the team wanted to impress the client and deliver a substantial working game, they needed a reality check as to what their core hours would have to be. Many learners are under the impression that work hours in the game industry are 9 to 5 when this is no longer a common practice and is different depending on the company, culture and timing of the production.	Stimulated Recall
	Mentor 1: I was also trying to impress upon them that deliverables and prototypes can come in all different shapes and form as well and it's yet another thing where we get stuck with a little bit of tunnel vision as far as how deliverables have to look like. That's what [company name] taught me. **Interpretation:** The strategy crosses over with the idea of documentation as a group genre, particularly in game design development. Learners were waiting too long to get started on their documentation because they felt everything had to be decided upon before they began. The mentor reminded them that documentation too was an iterative deliverable and they had to start soon as the entire document would be a substantial contribution.	Stimulated Recall
	Mentor 3: So a lot of this meeting is me explaining how a deal typically works and calming down any nerves, uncertainty.	Stimulated Recall

	Interpretation: The mentor is commenting on a mentoring session where over the course of 15 minutes, he is explaining in great detail a game publishing deal between an indie-game developer, an outsourced team (that they represent), and a third party publisher. This arose because of the project pivoting towards being used as a pitch for the client to sell the prototype that they developed to a publisher.	
	Mentor 2: In all of the game projects that I've made, none of them have every been the same. We do use similar tools but the tools evolve and change, but how we get things done and what problems we run into are always changing. **Interpretation:** The mentor is responding to the learner's beliefs that there is a set way to run a game project. The video recordings reveal that learners seem to be stuck in a particular way of doing things that are not really aligned with the changing practices of a particular industry. The mentor is an established producer with well-known titles to his name.	Video Recorded Session
	Mentor 1: I was also trying to impress upon them that deliverables and prototypes can come in all different shapes and form as well and it's yet another thing where we get stuck with a little bit of tunnel vision as far as how deliverables have to look like. That's what [company name] taught me. Taking all the thoughts required to say that you've got a viable game or app idea on paper and take it as far as the team can technically and recognizing it as viable deliverable. **Interpretation**: In the video-recorded session the mentor was discussing the importance of seeing the final documentation as part of the deliverables and used a story of a previous client who had impressed upon their team the urgency of final documentation.	Stimulated Recall

	Mentor 2: If you were to do a performance review and your manager says so what did you do these past three months. I did this, and this and did this cause here it is in my daily log. Oh yeah you were the one who had that breakthrough and no one remembers now but it was you, so maybe your contribution can be recognized. **Interpretation:** The mentor then related a real life experience where he had used the strategy of a daily log. The story was used to reinforce the importance of keeping a daily log as a tool the team could use to keep track of their contributions to the project.	Video Recorded Session

Quotes here represent a form of ***Socratic questioning*** including the use of silence as a method to elicit answers and provoke conversations from learners. The silences were observed as we watched the video recorded mentoring sessions.	Mentor 1: The next thing you're going to need to understand is his language. Is he wanting a prototype? [silence] **Interpretation:** The mentor here is challenging learners to interpret the client's meaning. This in order to align the team on their next steps in the game production pipeline.	Video Recorded Session
	Mentor 2: How do you think the meeting went? [with client] [silence] Learner 1: It was disorganized Mentor 2: So why was it disorganized? You knew the meeting was today at 10. [silence] Learner 2: We were unprepared. [other team members] Yeah, yup, yes. **Interpretation:** The mentor in this case understands that the client meeting was a failure because the learners did not organize it well. In a way he is trying to get them to articulate what the root of the problem was, driving home the importance of using an organizational tool (such as an agenda) to structure client meetings around. The tangible result that the learners all felt was a meeting that was 'all over the place' where very little was accomplished.	Video Recorded Session
	Mentor 2: At the beginning of the project do you guys remember me suggesting that one thing you want to do is a daily log? [silence]	Video Recorded Session

	Interpretation: This strategy has been categorized elsewhere as a proposal of a group genre that the team could use. I repeat it here because it was used to challenge learners to respond to the fact that they had not followed his advice earlier in the semester. The reason the mentor challenged the learners with the question was that they had forgotten an important contribution that they had made to the project earlier that they had not communicated to the client.	
	Mentor 3: So what's [learner name] role? [silence] **Interpretation:** This strategy crosses over with the strategy of surprise in that learners did not expect the mentor to ask them what, on the surface, was an obvious question. However, their responses on the video recording revealed an incomplete picture of what their team mates were contributing to the project.	Video Recorded Session

Quotes here combined with the context in which they were said represent a strategic use of ***humour*** in order to lighten up a situation and at times to show empathy.	Mentor 1: She felt ok and I teased her about it and we all got to laughing eventually. **Interpretation:** The comment came from an observation of one learner who on the video recording was demonstrating distance and disappointment from the rest of the team's conversation, because her idea was not understood nor acted upon by the client. The mentor can be seen interacting with her to change her mood and so I asked if her situation changed over the course of the mentoring session.	Stimulated Recall
	Mentor 3: You're all suffering from rubber ducky syndrome. Get out of your project room. Go get answers. **Interpretation:** The mentor was using a term followed by a definition of that term in order to get learners out of their project room and ask others for help that the rest of the team was unable to provide.	Video Recorded Session
	Mentor 3: I went through the same thing. You're going crazy in the first term and in this term you have one project, you can focus, you have more time to think but you're still going crazy. [laughter] **Interpretation:** In this case the mentor is reflecting on his experience of going through the MDM Program as they are. The purpose was so that he could reflect on his own experience in order to create empathy. The learner response is laughter as observed in the video recorded session.	Video Recorded Session

Quotes here often reference specific tools that learners had used in their previous semester work, or at the beginning of their project cycle. These I've categorized as ***group genres*** as discussed in relation to Cook and Brown's model in Chapter 2.	Mentor 1: I don't think we would have had a session without the board there. They had time to take in the entire board. **Interpretation:** The mentor is referring to a whiteboard drawing that captured what was said at the meeting. The use of whiteboards to visually capture creative meetings is a common tool used in the first semester across three courses.	Stimulated Recall
	Mentor 1: We actually start with what went well, what didn't work, what do we need to change when we have a similar meeting. (referencing Keep, Fix, Change tool) **Interpretation:** The KFC tool is introduced in the first semester during three overlapping courses. It is a group genre that structures the review of a prototype and provides the team alignment on next steps.	Stimulated Recall
	Mentor 2: They all have these tools in their toolbox but they're all doing a variety of other things. If no one organizes this meeting for them then it probably won't happen. So who takes responsibility for the tool? I think it will take a leader on a team to make it happen. **Interpretation:** The mentor here is commenting on the inability of any of the team members to rely upon an organization tool that they all learned in the first semester. Part of the mentors role is to elicit previous tools that they have already used so that learner's transfer those tools to new contexts.	Stimulated Recall
	Mentor 2: When they're in a meeting, it's another skill that they can bring to whatever company that they end up working with. It's the understanding that when you're in a meeting and you're not the one talking at the time, you're still participating in the meeting.	Stimulated Recall

	Interpretation: The mentor is responding to the video recorded session in which he is giving feedback to the team on how they can non-verbally show the client and their team members that they are acknowledging what is being said. This approach also demonstrates to the client that the learners are paying attention.	
	Mentor 3: I also can start to really make an observation. Are they really sticking to their Scrums every day? If I were to faithfully believe that they were doing scrums every day, then understanding their roles should be that much easier. **Interpretation:** The mentor is responding to the video recorded session where he facilitated learners to conduct a 360 on team performance. A discussion of team roles was observed that the mentor also uses to assess whether or not they are using a team genre known as a Scrum. Scrum is described in Appendix A and forms part of an Agile methodology to manage projects that learners were first exposed to in their first semester courses.	Stimulated Recall
	Mentor 1: To create that transparency where in term one, we [faculty] were all trying to stay on message and I don't think it hurts for them [learners] to almost expect that through all their conversations. **Interpretation**: Here the mentor reminds learners that in their first term they get used to similar tools, methodologies and practices surfacing in more than one class. He says this because in the video recorded session he refers to the idea of a 'core loop', which, is discussed in their Game Design class the semester previous.	Stimulated Recall
	Mentor 2: At the beginning of the project do you guys remember me suggesting that one thing you want to do is a daily log? [silence] **Interpretation:** The mentor reminds learners of the value of particular tools when it comes to managing what they do on a project. This comment was also followed by a memorable story to explain why the idea of a daily log as a group genre is important.	Video Recorded Session

	Mentor 1: This isn't the first time I've used this with this team in their project room. It's like leaving one sticky note with them. So a lot of times, I'll just write on the board while they are talking out certain ideas, blue sky. Don't' forget you're still in blue sky. Hopefully by Friday when you're talking to your client you've grounded that idea. But that little note is sitting there on the whiteboard. **Interpretation:** The mentor is commenting on my observation of a sticky on the whiteboard that had the words 'core loop' written on it. His intention is made more explicit and with this particular team became a group genre over the course of the semester: a mnemonic device to remember what was most important for a particular sprint.	Stimulated Recall
	Mentor 1: The idea of having [external facilitator] map what they were saying is not only to visually show what they were presenting and what she was retaining from it, but also an ex. that they also need to start transcribing things for themselves. They eventually do it in the room when they're brainstorming but I've never seen one from a debrief. **Interpretation**: The mentor's use of a graphic facilitator was in part to encourage learners to see the value of capturing ideas visually during a client meeting, and in the hopes that they would continue to use the tool on their own.	

Quotes here refer to mentors addressing ***learning goals***. They refer not just to mentors facilitating learners to state their anticipated goals of working on a project but also make reference to an important learning outcome of the projects course: to self-regulate.	Mentor 2: I have to reinforce that I'm just filling their toolbox, otherwise it'll be me directing their project which will take away from their ownership of it. **Interpretation:** The mentor here mentions his approach to providing learners with tools that they could use rather than ones they should. This was a comment that came from him providing a tool to the learners in a mentoring session in order to see if they gravitated towards using it. The important aspect of the quote, however is a reflection on the mentor's part of wanting learners to take ownership: a key characteristic of self-regulating behavior.	Stimulated Recall
	Mentor 3: They usually know the answers. They just need to hear it again. Otherwise if they're way off base I'll let them know. Typically, I start any of the meetings where I have them talk first before I provide my thoughts. **Interpretation:** The mentor is demonstrating his preferred way of conducting review sessions by having the learners speak first. This approach is interesting in that it encourages learners to provide their own reflection first as a starting point for discussion. It places their view of what they are learning up front and simultaneously emphasizes more importance on that, than on what the mentor might have to contribute.	Stimulated Recall
	Mentor 3: All I ask is one question. What does good like at the end of the term? They usually tell me from a team perspective and an individual perspective. And I keep that in mind to see if they are more or less aligned. And if they're all over the place that's fine because there's still plenty of time to align them, but also to see what their goals are. It gives me a clue.	Stimulated Recall

	Interpretation: The mentor is clearly challenging learners to be clear what they want to learn from the project. In doing so, he can also keep track of those early intentions and keep checking with them on their intended progress.	
	Mentor 3: What are we going to do for the rest of the term? There's still plenty of stuff. They can still Polish up the game. There's a showcase coming up in the summer. **Interpretation:** The mentor is referring to questions the learners had on the video recorded session. Learners seemed confused about next steps because they had delivered the final product early. The mentor's mention of the summer showcase demonstrates that although the final product was delivered to the client there were still unfulfilled learning goals to achieved, and that these formed part of their overall grad experience beyond the scope of the project itself.	Stimulated Recall
	Mentor 1: I usually ask for all their portfolios to get a sense of who they are individually. **Interpretation:** The mentor is commenting on the need to know his team members so that he can ensure he is mentoring them towards their intended career paths, which, form a part of their learning goals.	Stimulated Recall

Quotes here seemed to be best organized together under the category of ***productive failure*** as they make reference to aspects of learning through doing something where the effort leads to mistakes or to failure. The important aspect of learning through failure is the reflection that mentors facilitated in their review meetings, and the action that each learner takes in future to succeed.	Mentor 2: I think that also in order for them to improve they have to have something to contrast it. So they know this was a bad meeting. Maybe that will stimulate them in their next meeting to be more on the ball. Failure is a learning opportunity. This was they failed so maybe they'll use that as an opportunity to pull their socks up. **Interpretation:** The mentor is commenting on the team's disillusion with a client meeting that they felt was unsuccessful and that the failure was an opportunity for them to reflect upon what went wrong and why, so they can learn from the experience and avoid it in the future.	Stimulated Recall
	Mentor 1: Recognize that this insight is for you in the future so that if you recognize a similar thing happening on another project whatever it is, next year, next month, two years from now that you can recognize that this is happening and you need to do something about it. **Interpretation:** The mentor is commenting on the team's reflection that they were unable to respond in the moment to a client's critique about the prototype on the video recording. The team's lack of responsiveness to the client created a sense of mistrust on the client's part and made the client question their professionality. Reflecting on the meeting was important in order for learners to understand the importance of being prepared to justify all of their design decisions.	Video Recorded Session

	Mentor 1: The situation forced the team to pivot or present plan B and be much more realistic of the fact that you're only as good as the last meeting you walk out of. Especially in today's world where everybody's considering every investment high risk. All of the markets are saturated and it's really hard to be original. **Interpretation:** The mentor here is responding to the team's failure to sell the client on their first idea and their lack of preparedness on a second idea that they had prepared. The lack of preparation and putting 'all their eggs in one basket' was an assumption that was quickly challenged when the client stated that their game idea had already been done before.	Stimulated Recall
	Mentor 1: My goal out of this debrief was to get them to the idea of looking at their new sprint through a completely different lens. It was successful to get them to use the idea of being a product owner for a particular idea then allow all the ideas to be developed at a similar level and now they have to shift gears. **Interpretation**: The mentor attempted to facilitate learners to look ahead to their next phase of production through a different lens. This was in direct response to the client not understanding why the team had not moved on to developing ideas at a higher level of fidelity when he had already given them feedback that he was in agreement with their chosen direction.	
	Mentor 2: If I was to recognize an issue and before the meeting said ok we're going to have a preparation meeting. Make sure you guys are all dialed in, is then their performance in the meeting, real performance? Or is it coached performance? And if I keep doing that, the first time I don't do that, will they do it? Or because they've had that support and prop they won't do it because somebody didn't do it for them?	

	Interpretation: Here the mentor is emphasizing a principle of holding back and allowing learners a certain amount of flexibility to 'fail' in their performance at a client meeting. The intention is in part to provide learners with a more real experience of the failure, rather than him mentoring them ahead of time to mitigate all the possible things that could go wrong. The quote is in direct relation to the team's inability to set objectives for their meeting.	

Some quotes revealed an unexpected category I began to label as '***surprise***', to refer to those strategies I noted where mentors surprised learners by facilitating activities for a variety of different reasons that learners could not really prepare for in advance.	Mentor 3: There are strategies. I definitely come in with, 'cause I do come in with these meetings specifically with those goals in mind. I'm going to ask these questions. It remains conversational because that's what I prefer. But you go in with those specific questions in mind and you try to smooth it in as if it was a natural part of the conversation. So I don't want formal answers they can prepare for. I don't want them to come up with like I wonder what [my faculty] wants to hear. **Interpretation:** The mentor is commenting on his approach when he walks into a project room to mentor learners. While he has a particular set of strategies in mind prior to meeting the team for their session he prefers to, as he says, 'smooth' them into a conversation that seems more natural. In this way he is allowing the conversation to be directed by the learners, not solely by the questions he has come to the project room with.	Stimulated Recall
	Mentor 3: I ask them to describe the role of the person on their left. I always ask the other team members to describe a member and see if that person fills any gaps that others don't. The hope is, if one person cannot fully articulate their fellow team mate's role(s) then their other team members will be able to. **Interpretation:** The same mentor placed learners on the spot in order to test their awareness of what each of their other team mates was contributing on the project. This surprise tactic was effective for the team to realize how much or how little they knew about what each team member was contributing. Knowledge of each individual contribution is important as teams are meant to be self-managing. They need to be persistently aligned on a daily basis so that they know what tasks they are contributing for a particular sprint as they are co-constructing inter-dependent features.	Stimulated Recall

	Mentor 3: I do it in this format rather than giving them anything ahead of time. Or even when they ask so what's the purpose of this 360 and stuff, I keep it very almost don't worry about, keep it very vague until I'm there, because I tend to prefer answers that haven't necessarily been rehearsed in their mind previously. I want to get their first impressions and then later on I can follow up and then they've had time to really think of stuff. Then, for me I tend to believe that whatever comes out of their mouth first can be more along with the truth. That's really what that person does, rather than if I give them a lot of time several days to come up with an answer there could be a lot of B.S. that sounds really really good. **Interpretation:** The mentor here is referring to surprising students with a 360 reflective tool that he didn't want learners to prepare for. His preference was to put them on the spot as he felt their responses would be more honest and not thought through with too much preparation.	Stimulated Recall
	Mentor 1: [an entire mentoring session facilitated because of the sudden loss of a client]. I took into account their lack of experience in the industry and felt like I had to demystify the industry**.** They also had to know the client was giving them a choice of what to do. They had to decide. **Interpretation:** This entire session was completely unplanned and demonstrated the flexibility that mentors sometimes need to have, if they feel they need to facilitate more of a teaching moment. In this session after breaking the bad news that they no longer had a client, the mentor walked learners through a memorable story where he and his entire team were suddenly laid off in the middle of a production. The story and the lesson served as a reminder to learners of the realities of a rapidly changing game industry that they wish to transition into post-graduation.	Stimulated Recall
	Mentor 2: I start to recognize a bit more of the relationships on the team in terms of soft skills. Who is the one really driving production and who are the people really driving that bond?	Stimulated Recall

	Interpretation: In this example, another mentor who is facilitating a 360 mid-term review surprises learners by providing them feedback that they did not expect, on other aspects of their performance.	

Quotes here represent mentors ***fading/scaffolding*** as a strategy. Fading is predominantly demonstrated by the mentor's pulling back from the timing of and amount of time they provide mentoring to the team.	Mentor 3: Everything going forward is just replacing and iterating which they already have a rhythm for. **Interpretation:** The mentor is commenting on the team becoming self-sufficient without really needing his advice or supervision as they are now in control of the project and its development.	Stimulated Recall
	Mentor 1: So I've been able to pull back on the debrief. They get notes on performance but what transpired from the presentation is discussed more by the time and placed visually on the board, so that by the time I pull back completely they are discussing what to do with their next sprint. **Interpretation:** The mentor clearly uses language to demonstrate a 'pulling back' from mentoring. The team has become more self-managing and have found a natural rhythm to their reviews and next phase planning.	Stimulated Recall
	Mentor 1: I've walked in on stuff in the project room where they are much better in their critiques of themselves. Like, if [learner 1 or 2] imparts something with too much of an accent they will never say that in a debrief with me. So I am a different factor in the room at this point. **Interpretation:** The mentor is commenting on learners being more comfortable and proactive when the mentor is not with them. This demonstrates a more self-regulating team that is investing in the time to reflect upon their own performances without the need of the mentor being present.	Stimulated Recall

Quotes here represent mentors ***modelling*** a particular way of managing any aspect of the project and client. At times the learners can be seen modelling the behavior during the video-recorded session.	Mentor 1: I was cueing them to slow down in their presentation. Then they did it for themselves. **Interpretation:** The mentor describes two important strategies in this extracted quote. The first is that on the video recording he is demonstrating a non-verbal way to tell learners to slow down their speaking. This is because the client's first language was not English; that the learner in question's first language was also not English, and that the client was remote so was only able to rely on audio communication. The second point is that learners began to help each other in the same meeting by using the same cue the mentor had.	Stimulated Recall
	Team Member 1: [imitating Mentor 2's method of Socratic questioning and addressing another team member] What would you have done different if he [client] had come prepared? Team Member 2: [responds to team member 1 continuing the flow of the conversation without the mentor interfering] I would, I would have shown him what I was working on. **Interpretation:** The video recorded session clearly shows that learners are modelling the same style of Socratic questioning that their mentor had just employed.	Video Recorded Session
	Faculty 3: In my opinion these thoughts are going on constantly in their heads and they need to vent them out otherwise they keep spinning in there. As soon as they talk, verbalize it (and it's rare that someone wants to verbalize out loud to themselves), they just want someone to listen. I just show them how to listen. **Interpretation:** The interesting strategy that the mentor models here is listening. In doing so, he sets up a positive habit of listening that the learners can follow.	Stimulated Recall