5-2017

The Adoption of Project Based Learning in Graphic Communication Programs

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The Adoption of Project Based Learning in Graphic Communication Programs

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A Thesis submitted in partial fulfillment of the requirements
for the degree of Master of Science in the School of Media Sciences
in the College of Imaging Arts and Sciences of the Rochester Institute of Technology

May 2017

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Certificate of Approval

The Adoption of Project Based Learning in Graphic Communication Programs

This is to certify that the Master's Thesis of
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Acknowledgement

Firstly, I would like to express my sincere gratitude to my advisors, both Professor Myers and Professor Riordan for their continuous support of my research, for their patience, motivation, and immense knowledge. Their guidance helped me through completing the research and writing of this thesis. I could not have imagined having a better advisors and mentors for my study. I would also like to thank my thesis committee which includes my advisors and Professor Heusner for their insightful comments and support. My sincere thanks also go to all School of Media Sciences faculty and staffs, I am grateful and indebted to them for sharing their expertise, sincere and valuable guidance and for all the encouragement extended to me.

Getting through my thesis required more than academic support. I would like to thank my parents, Zainuddin Suradi and Zaharah Abd Jalal for their unconditional love, never-ending support, attention and prayers. Also to my husband, Muhammad Asyraf Ab. Wahab and all my siblings, Aezzaddin Azalea, Aezzaddin Emir Arif and Aezzaddin Emir Imran, for supporting me spiritually throughout the process of this thesis and my life in general. Not forgetting all my friends here in RIT. Thank you.

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Abstract

Project Based Learning (PBL) is widely recognized as an effective teaching method when compared to traditional lecture-based approaches in the classroom. Recognizing that the graphic communications industry needs employees with requisite skill sets and the established efficacy of PBL as a pedagogical technique for teaching those skills, the researcher examined the implementation of PBL in post-secondary institutions serving the graphic communications industry.

A cross-sectional survey was conducted to solicit information from educators in graphic communications programs in the United States. The questionnaire was designed to examine the factors which comprise PBL utilized in the classroom. PBL factors were derived from an extensive search of the relevant literature, and included critical thinking, collaboration, communication, creativity and innovation, self-direction, and local connections.

In the examination of the differences between lecture- and laboratory-based courses with PBL implementation, similarities as well as differences were noted when the mean ranks of the various factors were analyzed. The study also examined the various types of graphic communication courses taught by different degree programs; it is found that the associates' level schools are focused almost entirely on Graphic, Digital and New Media and Printing Technologies and Processes, whereas institutions awarding Bachelor's degrees offered more

diverse topics, including Business Management and Entrepreneurship and Materials and Sciences.

Finally, the research investigated the support-structures which are in place to support professional development for graphic communications educators. Respondents indicated that over three-quarters of administrators support teachers in their professional development, however funding and release time for development were not as widely cited.

Overall, to fully adopt these PBL activities as part of their pedagogy, it is crucial for them to prepare themselves with these teaching techniques. Further, having a clear goal of exposing students to real-work outcomes could help educators to shift the mindset of their students with not only requisite technical skills but also the desired soft-skills such as working collaboratively and managing projects.

Chapter 1
Introduction

The graphic communications industry has been subject to rapid technological change which brings both opportunities and challenges. Traditionally, the majority of the revenue for this industry was obtained from the printing side of the business, so-called "ink-on-paper" from traditional printing presses. Market segments within graphic communications include commercial printing, book publishing, and package printing. Today, the industry represents a broader range of communication packages that facilitate the communication and packaging needs of business. In addition to helping their customers communicate across a wide range of platforms, many processes in this industry also incorporate emerging technologies and current engineering.

These rapid advancements and the ensuing changes have had an impact on the formal educational institutions which support the industry. It is important for schools to align their course content to the changing needs of the industry. In response, many post-secondary educational institutions have embraced a cross-media curriculum, designed to support the broader needs of employers. It is also important to recognize that the graphic communications industry has shifted from one that required skill sets emphasizing craft-based work to one requiring more adaptable skill sets, including manufacturing, project management, and engineering, while requiring a deep knowledge of the technologies that support quality and efficiency needs.

In 2014, McCutcheon of U.S. Industrial Products, a recognized leader for the professional services network PricewaterhouseCoopers, highlighted that there are significant prospects and employment opportunities within manufacturing fields such as graphic communications that are not being filled. He added that there is a need for training programs resulting in skill-sets for the needs of employers. Further, Wells (2014) indicates that one of the ways to resolve this skills gap is for companies to work together with local educational institutions: graphic communications organizations need to communicate their needs to educational institutions to assist in the development of relevant training programs.

Furthermore, today's graphic communication companies, similar to other manufacturing companies, are increasingly integrating high-tech equipment that requires specific knowledge that overlaps into design and programming. This suggests that an emphasis on Science, Technology, Engineering and Math (STEM) skills are a good place to start. Wells (2014) indicates that skills such as deep planning, thinking, judging and collaborating are needed in the manufacturing industry to complement technical skills. He added that professionals in this industry need to be leaders and have leadership skills to handle the demanding work requirements.

Background

In 2014, Asian Development Bank (ADB) emphasized the role of educational institutions, including research centers, universities, and other such organizations, in imparting the knowledge and skill sets required by a technologically advanced industry. They also suggest that when knowledge is acquired effectively, it enables the assimilation and adaptation of that knowledge to the local needs of industry.

Moreover, ADB (2014) reports that the proportion of employees with tertiary level qualifications employed in knowledge-intensive industries is growing. However, there is a noted gap in knowledge and skills competency among these new employees. Therefore, there is a demand for education and training institutions to develop and provide flexible and responsive programs in shaping skilled technical professionals.

The role of educational institutions is critical in incubating and nurturing both the soft-skills and technical skills in their pupils. An improved system of education and training will enable the production of knowledgeable professionals that would be able to support innovation and sustain a growing economy.

Statement of the Problem

Knowledge and skills are intertwined. Technological advancements and automation have largely replaced the need for employees who perform routine tasks, while providing greater opportunities to those with higher-level skills. Technology also helps to empower workers to be more productive and creative. In an interview, Whitehead (2016) supports these statements when he states that the needs for specified skills and expertise are still crucial in the printing industry, both today and in the future.

A recent study by Kivunja (2014a) agreed that there is a need of a pedagogical shift in ensuring graduate's marketability in the job market. Observing the skills of the new learning that relates to career and life, he cited a landmark 2013 report published by The Partnership for 21st Century Skills (P21). This diverse array of skills is essential in both secondary education and in the workplace, and include those that convey the importance of goal- and time-management, while encouraging students to work independently and become self-directed learners.

Furthermore, students should also learn to interact effectively with others, working productively in diverse teams, and demonstrate both leadership and responsibility. Although these skills are not new, many cite that they have not been adopted universally among post-secondary programs. Kivunja (2014a) added that the higher education sector plays a major role in instilling these skills in their students in order for them to be prepared for meaningful and productive

employment opportunities. In an article by Lewington (2015), Fenton, a former instructor at Brown University commented that:

> "The technical skills are getting better and better in terms of what is being taught, becoming more targeted to specific industries and jobs, but the soft skills, the people skills, how to work with people traditionally have been left to the side," (Colleges respond to industry demands for 'soft skills', para.6)

It is widely recognized that specific technical skills need to be combined with project management, customer engagement, and general business knowledge. In order to be aligned with industry needs, curriculum innovations should be directed in this manner. It is important for students to experience environments that mimic the real-world workplace as many researchers cite this will enhance the development of these skills.

Ehiyazaryan and Barraclough (2009) found that there is a significant correlation between real world experience and students' employability. Through such activity, students are more motivated and engaged with the subject matter. This also impacted students' confidence level and reflective thinking. Effective learning requires suitable teaching methodologies and assessments.
Kivunja (2014b) agreed that the demands of the workplace require students to be engaged in critical and independent higher order thinking and real-world

problem-solving. He suggests that the new pedagogy should be applied as interactive activity within dynamic communities.

Correspondingly, the literature presently reviewed underscores the effectiveness of pedagogy incorporating project-based learning (PBL). Research supports that PBL is an effective method that can result in better-quality content learning, higher levels of engagement and more positive perceptions of the subject matter.

PBL, therefore, is widely recognized as an effective and successful method when compared to traditional lecture-based teaching. Recognizing the needs for employees in the graphic communications industry with the aforementioned skill sets and the established efficacy of PBL as a pedagogical technique in teaching those skills to students, it is curious that an extensive review of the literature revealed no studies which examined the implementation of PBL in post-secondary institutions serving this industry. Therefore, the present thesis examined the adoption of PBL in post-secondary institutions teaching graphic communications in the U.S.

Reason for Interest

The researcher would like to recognize the value in monitoring and leveraging trends of the printing industry that will impact graphic communication education in the future. This interest is developed from the researcher's undergraduate study and working experience in the printing industry as well as her future career prospect. The researcher would also like to help build knowledge of pedagogical approaches in graphic communications. The researcher would like to use the obtained knowledge as a graphic communication educator in the future. The researcher hopes that this study will provide insight to other educators and curriculum designers that teach in graphic communication programs.

Chapter 2
Theoretical Basis

The present research is designed to add to an extensive body of studies that examine the diffusion and adoption of educational initiatives. These studies share a common foundation: they are built largely upon the formative work of Everett Rogers in his *Diffusion of Innovations* (2003). First published in 1962, *Diffusion of Innovations* has been reprinted four additional times. Today, Rogers' concepts provide foundational underpinnings for nearly all adoption studies; the study proposed here is no exception.

Sahin and Thompson (2006) state that Rogers' *Diffusion of Innovations* (DOI) "…looks at both the adoption and the diffusion of an innovation" (p. 82) and Holland (1997) underscores the preeminence of this model, writing that it describes the "…process by which innovations are adopted, and the criteria that individuals use to access each innovation and the types of individuals who are likely to adopt an innovation through the process of dissemination" (p. 394). Rogers describes not only the characteristics of an innovation, but also outlines critical components necessary for the diffusion. These factors, which are outlined below, predicate much of the present research.

Characteristics of an Innovation

Rogers (1995) describes five characteristics of innovation that attract or repel adopters—relative advantage, compatibility, complexity, trialability, and observability. Each is summarized below.

- *Relative advantage* is defined as the extent to which the innovation is perceived as being superior to the current practice that it is intended to supplant (Rogers, 1995). In this manner, the relative advantage construct speaks to any benefits perceived by the potential adopter. In many contexts, these benefits are largely fiduciary; however, others include ease of use, social prestige, the possible immediacy of reward and even preventative measures.

- *Compatibility* is described as a factor that examines the congruence of the innovation with the needs of the potential adopter, including values, experience, and perceived needs (Rogers, 1995). In some instances, the innovation may or may not be compatible with the values and beliefs of the potential adopter or adopting organization.

- *Complexity* is defined as a characteristic of the innovation itself. Rogers (1995) writes: "…innovations that are seen as difficult to understand or adopt will diffuse more slowly, as few will voluntarily embrace change that

makes their lives more difficult" (p. 242). As such, complexity can be thought of as perceived ease of adoption and use of the innovation.

- *Trialability* depicts extent to which a potential adopter can examine an innovation before committing to full adoption (Rogers, 1995). Trialability may mitigate concerns among adopters and is especially critical in organizational contexts where multiple stakeholders can have influence over the adoption process.

- O*bservability* explains the extent to which a potential adopter can view the innovation as used by others (Rogers, 1995). Like trialability, observability presents the opportunity to see the innovation prior to a full commitment to adopt. In this manner, observability serves as a means of potentially persuading an adopter to accept the change.

Critical components of DOI

In addition to the characteristics which describe the characteristics of an innovation germane to its diffusion, Rogers (1995) outlines four critical components of diffusion: the innovation, communication channels, time, and the social system. Within the social system construct, the author details stages of the innovation-decision process. These stages are defined as knowledge,

persuasion, decision, implementation, and confirmation. As several of these constructs are pertinent to the present research, they are described below.

Innovation

Rogers (1995) describes an innovation as an "…idea, practice, or object that is perceived as new by an individual or other unit of adoption" (p. 11). This description is an especially apt one for the present study, where the innovation proposed to be investigated is PBL.

Communication Channels

Having established the salient characteristics of innovations, the exchange of information and ideas among potential adopters comprise important aspects of DOI. Communication channels are the means for communicating the innovation among individuals and organizations. Communication channels are necessary to connect parties wishing to discuss the innovation (Rogers, 1995). These channels represent the manner in which the message is conveyed: typical examples range from mass media to face-to-face communications and even social networking.

Time

Rogers (1995) further recognizes a temporal element: *time* is seen throughout the diffusion process and is evident in the innovation-decision process as a person moves from "…knowledge of the innovation through to its adoption or rejection…" (Rogers, 1995, p. 20). Time is also relevant in describing individuals as early or late adopters, how time affects the rate of adoption, and is "…usually measured as the number of members of the system that adopt the innovation in a given time period." (Rogers, 1995, p. 20).

Social System

The *innovation-decision process* is a sequence of processes and choices that ensue over a period; these processes are critical components of a social system. Through the innovation-decision process, an individual passes from "…first knowledge of an innovation, to forming an attitude toward the innovation, to making a decision to adopt or reject the innovation, to implementing the new idea, to confirming or rejecting the adoption of the decision" (Rogers, 1995, p. 161).

The *innovation-decision process* itself frequently has five stages as cited by Rogers (1995); namely, knowledge, persuasion, decision, implementation, and confirmation. *Knowledge* is comprised of exposure to an innovation as well as a comprehension of its functions. In some instances, knowledge may be described as an awareness of the existence of the innovation, and *how-to*

knowledge which details the information necessary to properly utilize the innovation. Rogers (1995) describes knowledge as the "…functioning principles underlying how the innovation works" (p.166). In the *awareness knowledge* stage, the innovation is introduced to peers. Rogers also recognizes the critical nature of the advocacy of the adoption of a given innovation.

Rogers (1995) recognizes the importance of *attitude or beliefs* held by an individual about the innovation. He contends that the stakeholder may have "…much to say about his or her passage through the *innovation- knowledge process*" (p. 167).

Persuasion is recognized as the next step in the innovation-decision process. This entails the formation of a favorable or unfavorable attitude towards the innovation. Rogers (1995) describes this stage in the process as where a person becomes more "psychologically involved" (p. 168) Here, an individual considers how it will apply to a current or future situation. It is during this stage that the person considers the potential benefits of the innovation (Rogers, 2003).

The *Decision* stage is a critical stage in the adoption of an innovation: here, a commitment to adopt or not adopt an innovation takes place. Decisions include full adoption, partial adoption, or non-adoption. *Rejection* is recognized by Rogers as two variants: active in which an adopter fully considers the innovation and then decides to reject, and passive in which the adopter never really considers the adoption of the innovation.

Implementation refers to carrying out the processes involved in putting the innovation to use. Before implementation, Rogers (1995) describes the adoption process as being merely a "…mental exercise." (p. 172). Since implementation requires behavior modifications, problems often are encountered at this stage, particularly in organizational contexts. When those tasked with implementation differ from the adoption decision makers, problems with implementation frequently ensue and are to be expected.

It is important to recognize that during the process of implementation, *re-invention,* otherwise known as *adaption* may occur and is described by Rogers (1995) as how the innovation "…changes and evolves during the diffusion process" (p. 174). Frequently, the outcome of re-invention is an innovation that more specifically meets the needs of the organization or of the adopters. Rogers (1995) lists factors driving reinvention:

"1. Innovations can be complex and difficult to understand;

2. Adopters lack full knowledge about the innovation;

3. The innovation is abstract;

4. Innovation is implemented to solve too many problems;

5. Local pride of ownership of the innovation; and

6. Change agent encourages adopters to fit the innovation to their needs" (p. 179).

Re-invention is a reflection of adopter behavior and a "process of social construction" (Rogers, 1995, p. 179) within organizations.

Finally, the *confirmation* stage represents the time of reinforcement of the innovation. This is the result of positive outcomes that are produced in the implementation process. Here, the adopter "…seeks reinforcement of the *innovation-decision* already made or reverses a previous decision to adopt or reject the innovation if exposed to conflicting messages about the innovation" (Rogers, 1995, p. 181). It is in this stage that adopters may decide to discontinue the innovation in favor of another type of innovation, known as *replacement discontinuance*; or because of dissatisfaction with the innovation, named *disenchantment discontinuance* (Rogers, 1995).

Adoption Characterization on the Basis of Innovativeness

Rogers' *Adoption Characterization on the Basis of Innovativeness* comprises what is perhaps the most widely-recognized aspects of his seminal work. Here, the innovativeness dimension is measured by the time in which an individual or organization adopts the innovation and is divided into five distinct categories, namely: Innovators, Early Adopters, Early Majority, Late Majority, and Laggards. Important characteristics are posited to distinguish those in each category. For example, early adopters are purported to exhibit greater social participation, are more interconnected, and engage more in information seeking.

Other cited variables include differences in socioeconomic status, personality, and communication behavior.

Rogers DOI and the Present Research

While the present study is cross-sectional in nature, those components of Rogers' DOI that examine "why" questions represent a delimitation and are therefore left to future researchers. Further, as the present study is not longitudinal in nature establishing the stage of adopters (e.g.: early, late) is not addressed. However, by defining the constructs that comprise PBL and inquiring about the adoption of these elements in lecture and laboratory classes in post-secondary institutions teaching graphic communications, critical components of Rogers' theories are examined. Those elements germane to the context of the proposed research include the recognition of PBL as an innovation as defined by Rogers, and the obtained results will potentially speak to the relative advantage, compatibility, complexity, and trialability of PBL to post-secondary graphic communications institutions. The recognition of DOI by Kautz and Larsen (2000) as "…largely a communication process, an information seeking and processing activity" (p. 12) underscores the appropriateness of Rogers' work to the research goals of the present study.

Chapter 3
Literature Review

The review of pertinent literature begins with published information regarding the status of the graphic communications industry, the goal of which is to support the need for an educated and skilled workforce. Once the status of the industry is established, the review cites studies that underscore the need for the industry to work cooperatively with post-secondary educational intuitions. Following this, the review concludes with research that supports the effectiveness of PBL as a teaching methodology. This review also concentrates on how PBL pedagogy could effectively impart industry-relevant skills to students.

The Graphic Communications Industry

Today, graphic communications include several diverse fields including traditional printing, digital printing, publishing, packaging, digital imaging, computer graphics, website development, cross-media application, digital data management, digital photography, printed electronics, and functional printing. Drupa (2016) cites the impact of automation on each of these sectors and notes that graphic communications firms need to be versant in multichannel applications and attuned to environmentally-friendly, "green" initiatives. One constant in these areas is shifting paradigms driven by rapid technological

change, which brings both threats and opportunities to established graphic communications organizations.

Digital printing has seen growth since its introduction in the early 1990's. In 2008, Pira International Ltd cited significant trends of the digital printing industry, concluding that digital printing is a reproduction process that has become dominant in complementing the conventional printing process as the development of this technology encompasses a broad range of printed products. As reported, the expansion of this technology is vast and substantial. According to Smyth (2015), the digital print penetration is forecasted to grow to 17.4% in value by 2020 from 13.9% in the year of 2015. In volume, it is forecasted to increase to 3.4% in 2020 from 2.5% in 2015. He also reviewed that this positive increase is due to the advantages that digital technology can offer to the field. Together with this advancement, new developments and innovations are introduced in the shape of new applications and business modes. Consequently, it also attracts new market embellishment.

Today, many manufacturers utilize hybrid printing and advanced multi-function applications. Many traditional printers have increased efficiencies via the internet using technologies such as web-to-print implementation and the Internet of Things (Gordon, 2014). Such innovations enable cross-media implementation and workflow optimization. Smyth (2015) also underscores that the collaboration of digital technology and print manufacturing results in effectiveness process workflows. Many aspects of the print production process are simplified with

automation. Process automation reduces human errors, enabling printers to be more cost-effective and save time, and frequently results in improved quality.

The needs of the industry are summarized by Pira International (2015). Table 1 displays the significant elements that business owners should look to in order to improve their organizational operations. It is clear that a workforce capable of thriving in an environment where these skills are required would need to be knowledgeable and prepared to embrace the dynamic nature of such a workplace.

Moreover, according to Fuller and Haefliger (2013), a business model is a critical part of an organization system. The model helps to manage the deliverance of jobs in the organization effectively; the workforce needs to be skilled in areas such as problem-solving, customer needs engagement, satisfaction delivery, and value monetization. Smyth (2015) added that training is needed in areas of management, sales, and marketing. Therefore, educators wishing to prepare students for this industry need to effectively implement curricula and pedagogical approaches conducive to these goals.

Table 1

Critical Success Factors for Print Businesses

	Not at all important	Relevant but not important	Fairly important	Very important	Critical
Ability to speed up turnaround times	0.0%	3.7%	19.6%	51.4%	25.5%
Development of a broader range of products and services	0.0%	6.5%	28.0%	41.1%	24.3%
Improvements in management skills	0.0%	8.4%	26.2%	51.4%	14.0%
Improvements in operator skills	0.0%	6.5%	29.9%	50.5%	13.1%
Cashflow improvements	2.8%	11.2%	21.5%	42.1%	22.4%
Overhead reductions	2.8%	6.5%	24.3%	52.3%	14.0%
Greater access to investment capital	4.7%	17.8%	35.5%	27.1%	15.0%

Source: Pira International Ltd

Note. The critical success factors for print businesses. Adapted from Smithers Pira (2015). The Future of Digital vs Analogue Printing to 2020. Surrey, UK: Pira International Ltd.

Industry Link to Educational Institutions

The Print and Graphic Scholarship Foundation (PGSF) cited that the graphic communications industry is the most diverse manufacturing industry in the U.S. Jobs offered in the industry include positions from professional and managerial to production positions including machine operation. PGSF (2015) projected that 40,000 employees would be needed each year through 2020. These employees will need to be versed not only in established and emerging technologies, but will also need to be able to adopt and implement innovations as they are introduced.

Marco (2014) urged that it is crucial for the educational institutions to complement the graduates' future needs. In order for them to produce and supply an educated workforce for the industry, it is necessary to instill new and diverse skills sets that match the current industry requirements. Among the skill sets required by industry are verbal and written communication, math skills, computer literacy, thinking skills and problem solving skills. (PGSF, 2015). In a 2015 *ME Printer* article, Romano stated that knowledge and training in both technical and management are vital. The educational institutions serving the graphic communications industry should be progressive alongside the development of the industry in order to help equip their graduates with the right skills. Also, in the same article, Starke supports these statements; he agrees that it is very important that graduates are equipped with theoretical and technical skills.

In the United States, post-secondary institutes include those offering courses in graphic communications programs in two-year associate's degrees (including colleges and degree-granting vocational institutions) and four-year undergraduate schools in which students aim to earn a bachelor's degree. Most courses in these programs are taught in two modes: lecture-only classes and those classes that also incorporate a laboratory component. In many institutions, these modes are offered concurrently in the same semester depending on the need of the subject course. Besides that, some schools also offer certificates and non-degree certifications.

McKeachie and Svinicki (2014) define lecture-based classes as those that utilize an instructional method which focuses on key concepts, principles, or ideas of a particular subject matter, the goal of which is to impart a general knowledge of the course content. In short, in lecture classes, students are exposed to the theoretical part of the learning. Laboratory classes, on the other hand, normally utilize a hands-on practical approach. Instructions are designed for students to be physically engaged with concepts in the field through active experimentation.

A recent study by Kivunja (2014a) agreed that there is a need for a pedagogical shift in ensuring graduate's marketability in the job market. The researcher observed the skills of the new learning that relates to both career and life. He reported that the skills outlined are essential in both college and the

workplace. These skills initiated students to manage goals and time, work independently, and become self-directed learners.

Besides that, students should also learn to interact effectively with others, including demonstrating the ability to work effectively in diverse teams while sharpening leadership skills and showing responsibility. Kivunja (2014a) cites that although these skills are not new, they have not been adopted by many institutions entirely. The researcher added that the higher education sector plays a major role in instilling these skills in their students in order for them to be ready for employment.

The Partnership for 21st Century Skills (P21) introduced "21st century skills," the goal of which is to improve the structure of teaching and learning in educational institutions. In so doing, P21 advises educators to foster these skills in their students through their curriculum and pedagogical approach. It has been identified that the commons skills associated and can be divided into main categories which include critical thinking, collaboration, communication, creativity and innovation, self-direction, and local connections.

Table 2

The commons skills associated with P21.

Skills	Definition
Critical Thinking	• Ability to analyze complex problem • Ability to investigate questions • Ability to evaluate different information • Ability to conclude based on evidence and reasoning
Collaboration	• Ability to work together to solve problems • Ability to work effectively and in teams to accomplish common goal • Ability to accept shared responsibility for completing task
Communication	• Ability to organize thoughts, data, and findings • Ability to communicate findings effectively through variety of media, both oral and written
Creativity and Innovation	• Ability to generate solutions to complex problem • Ability to refine solutions to tasks based on synthesis and analysis • Ability to combine findings and present in new ways
Self-Direction	• Ability to take responsibility for their learning by identifying topics to pursue • Ability to process students' own learning • Ability to review own work and respond to feedback
Local Connections	• Ability to implement students' learning outcome to local contexts

Source: www.roadmap21.org

Note. The commons skills associated with The Partnership for 21st Century Skills (P21). Adapted from Building Your Roadmap To 21st Century Learning Environments - A planning tool for education leaders. (2015)

Clearly, both theoretical knowledge and skills are intertwined. Skills including technical skills, management skills, and soft skills, are needed by industry. Technology helps to empower knowledgeable workers to be more productive and creative. Whitehead (2016) agreed when he states that the needs for specified skills and expertise are still crucial in the printing industry today and in the future.

Project Based Learning (PBL)

PBL is an umbrella term encompassing an array of pedagogical approaches designed to prepare students for the skill sets needed by industry. Marco (2014) suggested that it is fundamental that instructors in graphic communication programs apply collaborative pedagogy that will provide students with more practical experience and engaged learning. He cites the demographic characteristics of Generation-Z (birth years 2005 - 2025) along with the so-called "Millenials," otherwise known as Generation-Y (birth years 1983-2004.) The researcher added that understanding the learning preference of these two generational groups would assist instructors to better facilitate the curriculum design, content creation as well as teaching technique.

Correspondingly, the PBL approach is a student-centered teaching methodology. PBL adopted curriculum and instructional models support the reformation of teaching methodology that enables the conceptual understanding of disciplinary content. Markham, Larmar, and Ravitz (2003) stated that PBL

could be described as a systematic pedagogy that engages students learning the course content and skills. This process is applied through an extended inquiry process structured around complex, authentic questions of the subject matter, as well as guided with thoroughly designed projects and tasks.

Moreover, The Buck Institute for Education also supported that the PBL instruction method or PBL as an instructional method in which students acquire knowledge and skills by functioning to examine and respond to engaging and complex questions. Larmer and Mergendoller (2015) highlighted that their students could learn the contents and develop the skills through PBL as it imparts the important of concepts and in-depth understandings that are essential to academic disciplines. They also recommended that critical thinking, problem-solving, collaboration, and self-management should be emphasized in the projects. This is because these critical skills are vital for students to be successful in the future.

Having discussed the association of PBL, the factors that comprise PBL are now introduced.

Factors that comprise Project Based Learning

Barron and Darling-Hammond (2008) outlined the fundamentals of PBL as

i. students tackle realistic problems through the application of learning knowledge,
ii. students increase control over their learning experience,

iii. students work in a team, and

iv. program instructors function as coaches and inquiry facilitators.

The researchers added that PBL involves complex tasks and requires students to demonstrate solutions through a presentation or produce an actual proposed outcome. Furthermore, Harmer and Stokes (2014) reviewed the literature on benefits and challenges of implementing PBL. The researchers outlined factors that support PBL methodology in teaching as outlined by Barron and Darling-Hammond (2008). The significant factors are identified as learning by doing, real-world problems, role of the tutor, interdisciplinary, collaboration and group work, and an end product.

Similarly, Larmer and Mergendoller (2015) have also outlined seven elements that are required for a successful PBL projects in order to maximize students' learning and engagement in the classroom. These are described as challenging problem or questions, sustained inquiry, authenticity, student voice and choice, reflection, critique and revision, and public product.

Through thorough assessment of these outlined fundamentals and finding overlapping models of these concepts with the construct outlined by the 21st century skills, these factors were operationalized in the present study to better understand the adoption of PBL.

Project Based Learning (PBL) – Pedagogically Successful

Many researchers conclude that PBL is an effective pedagogical approach and indicated that the techniques produce better-quality content learning, higher levels of engagement and more positive perceptions of the subject matter. This supports that PBL is an effective and successful method when compared to traditional lecture-based teaching. Mergendoller and Maxwell (2006) suggest that PBL is able to boost achievement in students who struggle with traditional approaches. PBL was also discovered to nurture relatively higher interest in the subject matter.

Mioduser and Betzer (2007) agreed that PBL allows higher advantages in academic content knowledge when compared to the more traditional approaches. It is further noted that with PBL curricula, there is a great development of attitude towards technology. Furthermore, Walker & Leary (2009) supposed that students demonstrate improved and better-quality attitudes toward learning. Not only they are able to exhibit more engagement, but students also become more self-reliant, and have better attendance than in more traditional classroom settings.

Many researchers concluded that PBL is an effective and enjoyable learning technique. Vega (2012) reviewed in an article that an effective implementation of PBL increases the learning of content and improves one's attitude towards learning.

In addition, Capraro and Slough (2013) suggested that PBL has been implemented in various fields including medicine, education, economics, business, and engineering. Therefore, there is no reason to believe that graphic communications would be an exception to the effectiveness of PBL approaches. The concept of PBL provides contextualized and realistic experience for students, as it requires them to think critically and analytically. PBL also demands students to collaboration, peer communication, problem-solving and self-directed learning. Moreover, PBL requires students to demonstrate solutions through deliverables. These deliverables require hands-on work from the students themselves: examples here include dimensionally printed models and bound and finished printed matter.

Further, Valdez (2015) discussed that student participation in PBL increased their level of understanding of prospects beyond high school as well as learning and application of skills. Instructors have a greater awareness of the value that PBL creates for students together with the understanding of different ways to upkeep students' learning process.

Valdez (2015) added that there is a consistent focus on the requirement for PBL as a process used in supporting student learning and engagement. This process further assists the need for both students and instructors to collaborate in solving the issue at hand. While students acquire problem-solving skills, they are required to take the initiative in the decision-making process. The projects

they create are used as a tool of assessment. Thus, students are able to fulfill their academic and professional goals.

Implementation of PBL in Post-Secondary Schools

Components of PBL have been adopted in many post-secondary educational institutions. As indicated, student competencies in the post-secondary level need to go beyond content knowledge. Jones (2014) highlighted that today's bosses would likely hire employees who not only are able to demonstrate their degree knowledge but them who has the ability to apply this knowledge effectively in a diverse workforce situation. It is important to prepare and challenge the student to direct their own learning, solve problems of academic significance and to move beyond controlled information containment. PBL implementation aligned with the need of students exploring, developing, integrating, and resolving within the context of a particular assignment as knowledge construction at advanced levels take on new meaning.

In a landmark longitudinal study on the effectiveness of PBL, Rios, Cazorla, Diaz-Puente and Yague (2010) examine the advantages and difficulties of implementing PBL in engineering programs in Spain. The study observed the implementation by three phases through twenty years' observation.

Table 3

Phases of Project Based Learning Implementation

Phase	Year	Description
1	1987-1996	Ground breaking and validation of the methodology.
2	1996-2003	Expansion to other courses and incorporation of support elements.
3	2003-2009	An educational strategy linked to competences in project management

Note. Phases of Project Based Learning Implementation. Adapted from Project–Based Learning in Engineering Higher Education: Two Decades of Teaching Competences in Real Environments. (2010)

In this first phase, PBL is essential for completion of the coursework and is based on the construction of new knowledge from direct experience of the students. Students should acquire knowledge and be able to apply it to actual cases: this is one of the main elements of the strategy. Students participate in projects and procedures involving real-world content; this would provide students the opportunity to solve problems directly with external agents.

Rioz et al., (2010) added that in the second phase, only selected courses applied PBL methods. Most of these courses were of the final year semester. Collaboration with the industry and multidisciplinary groups were enhanced. Similar to the first phase, students are asked to observe and analyze facts through debates and exercises that discussed real situations involved in the projects. Thus, it will improve better understanding on linking theory and reality.

Furthermore, in the third phase, the different elements of competences are highlighted. The researchers conducted an experiment and applied project-based

learning methods to evaluate how it complements the approach of the IPMA Competence Baseline (ICB). The ICB outlined that there are three competence spheres of technical, behavioral, and contextual. This eventually enables the development of personal competencies such as teamwork, communication, openness, creativity, and the capacity for adaptation and innovation in problem-solving.

Also, in this phase the usage of technology is established as online support for teaching this method. Through this platform, both instructors and students are able to improve their communication. It is learned from this study that PBL is considered as a reasonable pedagogy to support the improvement of competences, and also linking teaching with the professional scope. PBL is also able to offer multiple possibilities for developing the three main competences; technical, behavioral, and contextual within its method of collaboration and active involvement.

In a similar case study, Fernandes (2014) reports that PBL implementation in higher education provides the techniques that help to improve student learning and prepare graduates for professional practice. This research focused on three main categories: linking theory to practice, developing skills for professional practices, and challenges in PBL implementation. Through questionnaires and focus group interviews of both students and teachers, it was found that PBL promotes deep-level learning and imparts important skills for professional

practices. According to students, they were greatly satisfied with the level of interdisciplinary applied in their assignments through PBL.

Further, it is suggested that projects developed in the application of PBL are able to link theoretical understanding to real work practice. Students commented that PBL-based projects allow them to be more interested in learning the concepts application and enables them to develop the technical skills needed to accomplish given projects. Also, students confirmed that they were able to acquire transversal skills such as problem-solving, time management and communication skills. They realized the importance of teamwork and established the significance of developing these skills in order to work effectively in their future professional practice.

Conclusion

While there are many published studies that examine PBL and its effectiveness in delivering course curriculum in various programs such as medical and engineering, there is no found research that discussed the adoption of PBL in teaching graphic communications at post-secondary institutions. Therefore, it is suggested that an investigation in this area could be meaningful to educational institutions, the graphic communications industry, and future researchers in this domain.

Chapter 4
Research Questions

The objective of this research is to determine U.S. post-secondary institutions utilizing Project Based Learning (PBL) in Graphic Communication courses. This research will address the following research questions:

1. Does the adoption of PBL factors differ based on class types (lecture classes and laboratory classes) of Graphic Communications courses?

2. Is there a difference in the types of Graphic Communication courses taught by different degree programs? Specifically, do institutions granting Associate's Degrees offer different types of Graphic Communication courses than institutions offering Bachelors' and Masters' Degrees? Types of courses are defined as:

    a. Graphic, Digital, and New Media
    b. Printing Technologies and Processes
    c. Material and Science
    d. Business Management and Entrepreneurship

3. What is the nature of the structures that support the professional development of Graphic Communication post-secondary educators in terms of their content knowledge?

Chapter 5
Methodology

This chapter discussed the methodology used in the present research. A cross-sectional survey will be conducted, soliciting information from educators in graphic communication programs at post-secondary institutions in the U.S.

Questionnaire

A questionnaire was designed to determine the activities that describe PBL applications in teaching graphic communication courses. This thesis used skills defined as 21st century skills as the variables. The types of skills that were examined were critical thinking, collaboration, communication, creativity and innovation, self-direction, and local connections.

The survey included three sections, the first of which elicited demographic information from the respondents. Besides that, the questionnaire was designed to examine the utilization of PBL factors to understand if there is difference between the application of PBL constructs in lecture-based classes versus laboratory-based classes, and to compare two-year degree programs with those offering four-year degrees. Finally, the third section of the questionnaire asked if support-structures were in place to provide professional development and enhancement for graphic communications educators.

Sample

Graphic communication programs were identified by conducting keyword searches. The present study utilized the *Print and Graphic Scholarship Foundation*: *2016 -2017 Directory of Schools* (PGSF) as a sampling frame. Initially, there were 210 listed schools in the directory. It was then reduced to 180 after crosschecking the entries with their respective websites. It is found that 30 schools no longer offered graphic communication programs.

According to PGSF, these institutions offer a complete course of study in graphic communication technology, which includes instruction in prepress, press, and finishing operations. Besides that, they also deliver specialized graphic communication training in fields such as science, chemistry, management, or education. These included institutions offering two-year degree programs, four-year degree programs, and graduate school.

Procedure

Prior to contacting identified institutions, approval was granted by the Human Subjects Resource Office of Rochester Institute of Technology (RIT). This office serves as an internal review board, with a goal of protecting human subjects consistent with RIT's mission and vision in this area. Once the approval was given, the survey was distributed to contacts identified in the sampling frame.

Using a procedure suggested by Dillman, Smyth and Christian (2015), introductory emails were sent to all the potential participants informing them that they were selected to participate in the study, the introduction included background and contact information. After three days, the initial survey invitations were sent out to the sampling frame. These emails consisted of an invitation, instructions, a link to the online survey and the informed consent information. After one week, a second reminder email was sent to remind non-respondents of the survey. At the end of the third week, final reminder emails were sent.

Finally, the participants were sent thank-you correspondents. The collection of data was closed after four weeks. As this was web-based quantitative research, all correspondence with the potential participants was done via email. Finally, the data were analyzed by applying descriptive statistics.

Having reviewed the methodology, the thesis now turns to the results.

Chapter 6
Results

This chapter describes the analysis of the data collected for the study of the adoption of PBL in graphic communications programs for post-secondary education in the U.S. It is very important to understand the meaning of the collected data in order to draw relevant conclusions. The results of the data analysis are presented in graphical and tabular form.

Demographic Information

The first section of the survey observed the demographic information of the respondents. Graphic communications educators were identified through the PGSF directory. One hundred and eighty of the qualifying institutions received the introductory letter, of these three disqualified themselves from participation via email correspondence prior to receiving the link to the survey. Of the 177 remaining institutions, 51 responded to the survey representing a 28% response rate. Of these, however, two indicated that their institution no longer offered graphic communication courses, therefore their response was not included in the analysis. Forty-nine usable responses remained for the subsequent analysis.

As indicated in Figure 1, the percentage of respondents reporting their age as 50 or older was 76.6%. This is followed by 17% of respondents who are 45-

49%, 4.3% of respondents are 40 to 44 years old and 2.1% who are between 30 to 34 years old.

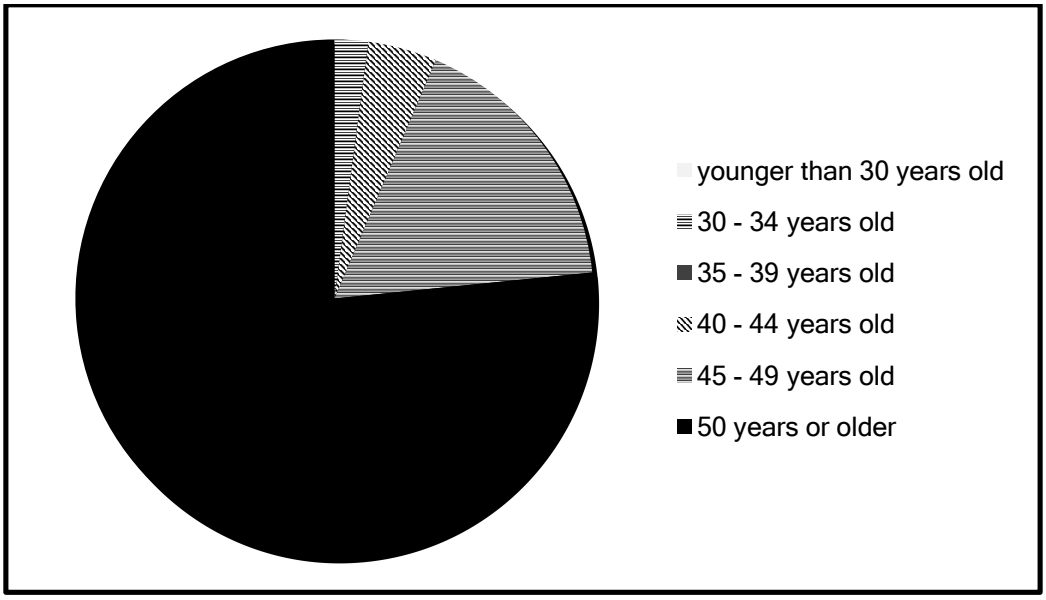

Figure 1. Percentage of Graphic Communications Educators Age Distribution

Respondents also reported their years of experience in the graphic communication industry as displayed in Figure 2. Here, 78.7% of the educators reported more than 15 years of experience. Besides that, 14.9% of the respondents have approximately ten to 14 years of the relevant industry experience, and nearly 6.5% of the respondents have less than ten years of industry experience. In summary, the respondents were therefore overall experienced educators and veterans in the graphic communications industry.

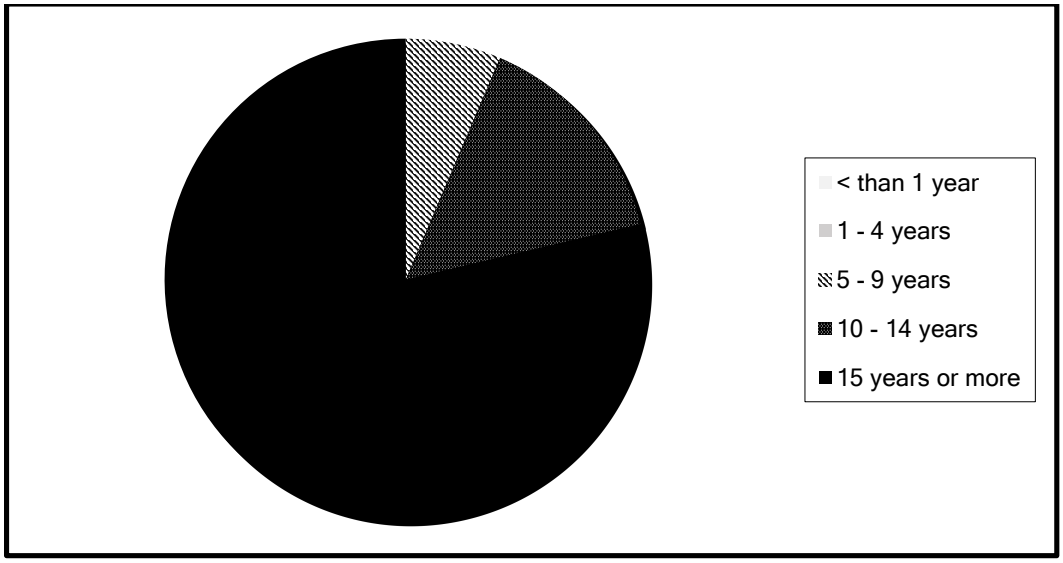

Figure 2. Percentage of Graphic Communications Industry Experience (Years)

Having discussed the sampling frame, response rate, and demographic information, the analysis now turns to the types of degrees offered by the responding institutions.

Types of Degrees for Graphic Communications Programs in the U.S.

As indicated in Table 4, over 24% of the responding institutions offered vocational certificates, over 61% offered associate's degrees, nearly 35% were bachelor's degree-granting institutions, and over 14% offered a master's degree. None of the responding institutions indicated that they offered any type of doctoral degree.

Table 4

Types of Degrees Offered for Graphic Communications Programs: Frequencies and Percentages (n = 49)

Types of degrees	*f*	%
Vocational	12	24.5
Associate's Degree	30	61.2
Bachelor's Degree	17	34.7
Master's Degree	7	14.3
Doctoral Degree	0	0

In subsequent analyses, the present study categorizes the institution by those where the highest degree granted is associate's, including those that offer vocational and certificate programs in addition to the two-year degree. A second category for the present analysis are those institutions where the highest degree granted is a bachelor's or a master's, as indicated in Table 5.

Table 5

Types of Degrees Offered for Graphic Communications Programs: Frequencies and Percentages (n = 49)

Types of degrees	*f*	%
Vocational and Associate's Degree	12	24.5
Associate's Degree Only	16	32.7
Others	21	42.9

Having discussed the types of degrees offered by the responding institutions, differences in lecture-based and laboratory-based courses are reviewed.

The Influence of PBL Factors in Content Delivery

Using the PBL factors identified in the literature, respondents were asked to indicate whether the particular activities were part of their lecture-based and laboratory-based coursework. Using a Likert-like scale, respondents indicated whether they strongly agreed, agreed, neither agreed or disagreed, disagreed, or strongly disagreed with each factor as a component in their respective course. The data were coded with strongly agree at 5, agree at 4, neither agree nor disagree at 3, disagree at 2, and strongly disagree at 1. The arithmetic means were calculated, and the factors were ranked from highest to lowest in both lecture-based and laboratory-based courses, as indicated in Table 6.

Table 6

Comparisons of PBL Factors between Lecture-Based and Laboratory-Based Courses in Graphic Communications Programs. (n=49)

Lecture-Based Courses		Laboratory-Based Courses	
PBL Factors	$\overline{x}$	PBL Factors	$\overline{x}$
Analyze and solve problems, think critically in an in-depth and sustained way	4.08	Work in collaborative teams that employ the skills of group members when completing projects	3.53
Do presentation of findings, results or conclusion for projects assigned	3.98	Reflect on the quality of the project or their learning	3.53
Present work in front of an audience	3.84	Do presentation of findings, results or conclusion for projects assigned	3.51
Reflect on the quality of the project or their learning	3.84	Engage in extended investigations	3.40
Inquire into a topic in depth	3.80	Inquire into a topic in depth	3.40
Engage in extended investigations	3.78	Present work in front of an audience	3.40
Specify content standards that projects were designed to meet	3.65	Taught before the project started	3.36
Taught before the project started	3.57	Specify content standards that projects were designed to meet	3.28
Use driving question or problem statement to focus projects	3.49	Analyze and solve problems, think critically in in-depth and sustained way	3.19
Work in collaborative teams that employ the skills of group members when completing projects	3.37	Use driving question or problem statement to focus projects	3.04
Use planning template to design projects	3.10	Use planning template to design projects	2.94

Having examined differences in PBL constructs for lecture-based and laboratory-based courses, the analysis now examines the types of graphic communication courses offered by the degree-granting institutions.

Types of Graphic Communication Courses Offered by Degree-Granting Institutions

Graphic communication incorporates diverse fields which include traditional printing, digital printing, publishing, packaging, digital imaging, computer graphics, website development, cross media application, digital data management, digital photography, printed electronics, and 3D printing. Today, graphic communication courses generally emphasize one of the below content areas:

a. Graphic, Digital, and New Media,

b. Printing Technologies and Processes,

c. Material and Sciences,

d. Business Management and Entrepreneurship.

The research inquired about the types of courses offered in graphic communication programs. As previously indicated, respondents were grouped into those offering an Associate's degree as the highest degree granted, versus those that offered baccalaureate and above. Respondents indicated their respective course content segments for both lecture- and laboratory-based courses as shown in Table 7.

Table 7

Lists the Topic Area by School Type for Lecture-Based and Laboratory-Based Courses (Associate Degree vs. Bachelors' and Masters' Degree): Frequencies and Percentages

	Associate's Degree		Bachelors' and Masters' Degree	
Topic Area	*f*	(%)	*f*	(%)
Lecture-Based Courses	*(n=28)*		*(n=21)*	
• Graphic, Digital and New Media				
Yes	23	82.1	14	66.7
No	5	17.9	7	33.3
• Printing Technologies and Processes				
Yes	15	53.6	12	57.1
No	13	46.4	9	42.9
• Material and Sciences				
Yes	0	0	2	9.5
No	28	100	19	90.5
• Business Management and Entrepreneurship				
Yes	0	0	8	38.1
No	28	100	13	61.9
Laboratory-Based Courses	*(n=28)*		*(n=19)*	
• Graphic, Digital and New Media				
Yes	19	67.9	8	42.1
No	9	32.1	11	57.9
• Printing Technologies and Processes				
Yes	14	50.0	7	36.8
No	14	50.0	12	63.2
• Material and Sciences				
Yes	0	0	1	5.3
No	28	100	18	94.7
• Business Management and Entrepreneurship				
Yes	2	7.1	3	15.8
No	26	92.9	16	84.2

Furthermore, respondents were asked about the primary focus of the graphic communications programs with regard to lecture-based courses. In Table 7, the result shows that graphic, digital, and new media has the highest percentage at 82% in the lecture-based courses for associate's degree programs. This is then followed by printing technologies and processes which is over 53%, while for the bachelor's and master's degree programs, both showed responses of 66.7% and 57.1%, respectively.

In addition, 100% of the respondents recognized that the content for lecture-based courses in the associate's degree programs did not emphasize materials science or business management or entrepreneurship. Conversely, 9.5% of the respondents from the higher-degree institutions teach materials and sciences for lecture-based courses while 38.1% reported business management and entrepreneurship as a primary topic.

The thesis now turns to the topic areas in graphic communication programs for laboratory-based courses. Interestingly, the primary concentrated topic area that was reported was nearly the same for laboratory-based courses as it was for lecture-based courses. Specifically, graphic, digital and new media was reported at 67.9% for associate's degree and 42.1% for the higher degree programs. Nearly 50% of the laboratory-based courses focused on printing technologies and processes, which is slightly lower when compared to lecture-based course for this content taught at the Associate's degree level. However, printing technologies and processes is higher at the two-year level when

compared to the courses offers in Bachelors' and Masters' degree programs, which is reported at 36.8%

Furthermore, over 7% of the content for laboratory-based courses focused on business management and entrepreneurship for associate's degree institutions while 15.8% is being taught in the bachelor's and master's programs. In comparison, only 5.3% of laboratory-based courses focus on material and sciences content at the institutions which are granting higher degrees. Like the lecture-based courses, associates' degree institutions reported no offerings in materials science.

Identifying the structures that are in place to support professional development was also a key goal of the present research. The analysis now discusses the obtained results from this part of the survey.

Structures That Support Professional Development

Respondents were asked about the support structures that are in place to facilitate the continuing education of teachers of lecture- and laboratory-based graphic communication courses. Specifically, for the present study support structures are manifest in three ways: support in terms of funding, support in release time from teaching responsibilities, and general support from the administration within the institution. Results are listed in Table 8 and Table 9: the former displays overall results for all responding institutions, while the latter

compares institutions offering associate's degrees versus those that offer bachelor's degrees and above. "None" in the tables refer to no answer.

Table 8

Support Structures for Educators' Professional Development between Lecture-Based and Laboratory-Based Courses in Graphic Communications Programs: Frequencies and Percentages

Factors	Yes		No	
	f	%	*f*	%
Lecture-Based *(n=49)*				
A. Funding Support	32	65.3	7	14.3
B. Release Time	28	57.1	11	22.4
C. Administration Support	37	75.5	2	4.1
Laboratory-Based *(n=49)*				
A. Funding Support	31	66.0	5	10.6
B. Release Time	28	59.6	8	17
C. Administration Support	36	76.6	0	0

Table 9

Support Structures for Educators' Professional Development between Lecture-Based and Laboratory-Based Courses in Graphic Communications Programs (Associate Degree vs. Bachelor Degree and Masters' Degree): Frequencies and Percentages

Factors	Yes		No	
	FR	%	FR	%
Associate Degree				
Lecture-Based (n=28)				
Funding Support	19	67.9	2	7.1
Release Time	15	53.6	6	21.4
Administration Support	20	71.4	1	3.6
Laboratory-Based (n=28)				
Funding Support	19	67.9	2	7.1
Release Time	17	60.7	4	14.3
Administration Support	21	75.0	0	0
Bachelor Degree and Master Degree				
Lecture-Based (n=21)				
Funding Support	13	61.9	5	23.8
Release Time	13	61.9	5	23.8
Administration Support	17	81.0	1	4.8
Laboratory-Based (n=21)				
Funding Support	12	63.2	3	15.8
Release Time	11	57.9	4	21.1
Administration Support	15	78.9	0	0

Overall, from the data collected it can be summarized that the institutions offering the graphic communications programs across the U.S. generally utilize the PBL factors in their pedagogical methods. It was found that, although not as dramatic, there is a difference between the PBL implementation in both lecture-

based courses and laboratory-based courses. Moreover, the findings also conclude that there are differences in the focus of topic areas and types of courses based upon the degrees offered. Discussion and implications of these results are reviewed in the subsequent chapter.

Chapter 7
Summary and Conclusions

Having presented relevant demographic information together with the results germane to the research questions, the following chapter analyzes these data in terms of meaning and implications. The discussion is then followed by recommendations for future studies.

Analysis and Interpretation of the Data

PBL is a pedagogical approach that focuses on students-centered learning supported by distinctive teaching methodologies. The curriculum and instructional models adopted in PBL represent proven pedagogical methods and call for the reformation of traditional teaching practices based on a rote learning approach. From the literature that has been reviewed in the present thesis, it is learned that many studies have underscored the effectiveness of pedagogy incorporating PBL. Moreover, the result of better-quality content learning, higher levels of engagement and more positive perceptions of the subject matter established that PBL is an effectual method.

By defining the concepts that encompass PBL and inquiring about the adoption of these elements in lecture and laboratory classes in post-secondary institutions teaching graphic communications, critical components of Rogers'

theories are examined. DOI has been recognized as being primarily a process of communication, information seeking and processing (Kautz and Larsen, 2000). The present study not only recognizes PBL as an innovation, but also provides a foundation for the status of the adoption of the relevant PBL components in this context. Clearly, the widespread adoption of PBL in the surveyed schools speaks to the relative advantage and compatibility of this teaching method. Due to the extensive utilization of PBL, Rogers' complexity and trialability constructs were not addressed, as these are more germane to innovations which are not as widely used.

The research was conducted through a cross-sectional survey methodology which resulted in quantitative data. According to Wysocki (2004), this type of research is best applied to elicit information from subjects and learn about attitudes or behaviors, as reported by the respondents. She added that the survey is a common way of conducting research. This is because it is versatile, efficient and the results can be generalizable. Besides that, this method is also often the only way to obtain information from respondents spread out over large geographic areas. The discussion now focuses on results specific to the research questions which drove the study.

Research Question 1: Does the adoption of PBL factors differ based on the type of class (lecture-based or laboratory-based)?

The first research question asked if the adoption of PBL factors differ based on class types, which are lecture-based classes and laboratory-based classes for graphic communications courses. These questions were designed for responses in five-point Likert-like scales: Strongly Disagree, Disagree, Neither Agree or Disagree, Agree and Strongly Agree. This allowed them to express their attitude regarding the statements given in the survey. From the literature, 11 factors which comprised PBL were identified and used as variables. Calculating the mean responses for lecture- and laboratory-based courses and ranking the results permitted comparisons of differences in the two classroom approaches regarding PBL constructs.

As illustrated in Table 6, the respondents agreed that most students in the graphic communications programs are required to "analyze and solve problems, think critically in in-depth and sustained way". This factor is ranked first at the mean of 4.08 for lecture-based courses. These result underscores the significance of critical thinking skill and problem-solving skills as the most popular PBL factors mentioned in the literature reviewed for this research. Barron and Darling-Hammond (2008), Harmer and Stokes (2014), mentioned in their study that these two skills are of the fundamental techniques to be taught in a PBL pedagogy. Besides that, Kivunja (2014b), Larmer and Mergendoller (2015) suggested that initiative of including these skills in doing projects should be emphasized. Also, Rioz et al., (2010) applied these factors extensively in all three

stages of their longitudinal research. The present study, therefore, validates the finding of these previous researchers.

However, the very same PBL factor for the laboratory-based courses was not as highly ranked with the mean of 3.28. This shows that in many institutions across the U.S., this PBL factor is not intensively applied for this mode of courses. Holmes (2015) in an article "Inside Science" mentioned that it is challenging to adopt the teaching of critical thinking in laboratory-based courses. She added that when laboratory-based classes were designed to assist students' learning and do experiments, laboratory-classes today do not support exploration of the matter as students will be given list of instructions and tasks to be conducted. Again, the present results validate this work. This gives an insight of why this particular PBL factor is not widely adopted in the laboratory-based courses generally.

For lecture-based courses, the second highest ranked construct was that students are required to "do presentation of findings, results or conclusion for projects assigned" with the mean score of 3.98. This same PBL factor is ranked third for laboratory-based classes with the mean of 3.51. These results are consistent with Barron and Darling-Hammond (2008) who emphasized that one of the key PBL activities involves requiring students to demonstrate a solution through a presentation or to produce an actual proposed outcome. This is because it is one of the many ways in which performance of the students are being assessed. This type of assessment is proven to contribute to students'

learning. As the differences of means for both course modes are not large, it is suggested that this PBL factor is well imparted in the current graphic communications teaching method across the U.S.

Furthermore, the third most applied PBL factor for lecture-based courses is the requirement for students to "present work in front of an audience" with a mean score of 3.84. According to Barron and Darling-Hammond (2008), the audience can be referred to as groups of faculty, visitors, parents, or other students. The opportunity of presenting their project in public will not only help students examine both how they learn and how to improve their performance, but it is also a way of informing them that their work is valued. Eventually, it reinforces to them the importance of their undertakings in a real-world context.

Comparably, for the laboratory-based classes in graphic communication programs, the factor of "working in collaborative teams that employ the skills of group members when completing projects" ranked first with the highest mean of 3.53. Kivunja (2014a) recommended that teamwork is a great practice for students to learn to interact effectively with others. Through projects that require teamwork, it enables students to learn to work productively with the diverse teammates. These would empower them with both leadership skill and having a sense of responsibility as they are essential in both secondary education and in the workplace. Surprisingly, this same PBL factor ranked second to last with a mean score of 3.37 for lecture-based course.

Moreover, for both course pedagogical modes, the PBL factor requiring students to "use planning template to design projects" ranked the last out of the eleven for lecture-based and for laboratory-based courses. The literature suggests the importance of this factor: Barron and Darling-Hammond (2008) report that having to learn the ability to plan would allow students to develop competence aptitudes. Planning skills also require the practice of setting priorities, systematizing individual and group efforts, employing discipline, and determining effective communication. As mention by Hewlet (2014), being able to plan work systematically is one of the important skillsets beside having the right technical skills, in today's working environment. Therefore, it is suggested that this PBL factor should receive more attention in the future in order to produce a holistic thinking graduate in the graphic communication industry.

Research Question 2: Is there a difference in the types of graphic communications courses taught by different degree programs? Specifically, do institutions granting associate's degree offer different types of graphic communications courses than institutions offering bachelor's and master's degrees?

The second research question is summarized in Table 7. Here, the topic areas of lecture- and laboratory-based courses are compared by the type of degree offered, namely, those institutions offering associate's degree only versus bachelor's degree and above.

Perhaps the most interesting finding here is the lack of Materials and Sciences and Business Management and Entrepreneurship courses being taught at the two-year schools. There were no reported Materials and Sciences courses being taught in either lecture-or laboratory-based formats, and no Business Management and Entrepreneurship courses taught in the lecture format for these associate's degree-granting institutions. Only two of these schools reported the business-focused courses in the laboratory format.

These materials- and business-related courses were reported as being taught in the bachelor-level institutions in the lecture- and laboratory-based formats, albeit in a minority. As such, with the baccalaureate-level programs the distribution of the more popular courses, identified here as Graphic, Digital and New Media and Printing Technologies and Processes, generally did not match those of the two-year schools.

This finding indicates that the associate's level schools are focused almost entirely on Graphic, Digital and New Media and Printing Technologies and Processes. If employers wish workers trained in the materials and business domains, and are seeking employees at community-type colleges and other two-year institutions, this presents an action item for them to spearhead efforts with their local colleges to work together in the development of such courses. Otherwise, they will need to seek employees at the Bachelor's level or otherwise consider on-the-job training initiatives.

Research Question 3: Are there support-structures in place to support professional development and enhancement for GC educators?

Table 8 examines the differences between the support structures for lecture- and laboratory-based courses overall, and in a second analysis these are divided by associate's degree institutions versus bachelor's degree and above schools.

In Table 8, it is noted that over three-quarters of administrators support teachers in professional development, however these numbers drop when funding and release time are considered. Funding for development seems more prevalent than release time with over two-thirds of the responses indicating that funding is available for both lecture- and laboratory-based courses. Over half of these same institutions indicated release time from teaching is available for development. Turning to Table 9, similar results are noted with minimal discrepancies between associate's and bachelor's degree-granting schools.

These results indicate an overall level of support available for educators in his area. While it could be argued that 100% support in all areas here would be desirable considering the importance of educators in this field, the results are nonetheless encouraging. It is suggested that educators without access to support seek initiatives which aim to educate teachers at little or no cost, including massive on-line courses, social networks, and even local libraries.

Overall, the adoption of PBL in graphic communication programs has implications for various constituencies. For the educators, in order to fully adopt these PBL activities in part of their pedagogy, it is crucial for them to prepare themselves with the new learning models. Not only that, they should also deepen their conceptual understanding towards the context of the related courses. Understanding and having a clear goal of exposing the students to the real-work outcomes would also help the educators to shift the mindset of just teaching but managing projects. This eventually will help educators to better plan their classes consistent with proven PBL methods. Also, considering the importance of all these PBL factors, educators could also strategize the implementation in both lecture-based courses and laboratory-based courses.

In addition, textbook publishers and software designers could work together with industry and the graphic communication educators and curriculum development professionals to produce resources aligning the implementation of these skills alongside the PBL learning activities. Instructional materials embody the resources that educators use to develop student understanding of subject-specific concepts and skills in the representation of the curriculum. These teaching materials include textbooks, workbooks, laboratory manuals, supplies and equipment, as well as software or websites. A cohesive approach among the stakeholders is the best opportunity to benefit the students, schools, and industry.

Future Research

All studies have limitations, the current research is no exception. These limitations, however, offer important implications for future researchers in this domain. The primary limitation of the present research is that it is conducted only for educators of graphic communication, teaching post-secondary education, in the U.S. Besides that, as the present study is cross-sectional in nature, it only investigated the "what" questions related to the adoption of PBL factors. Those components of Rogers' DOI that examine the "why" questions signify a limitation and are therefore left to future researchers with a more qualitative approach. For example, a future research could design a study designed with opinion-based questions, this would enable deeper understanding of the PBL factors being applied at all the institutions offering graphic communications programs. It would also give an in-depth insight of how specifically PBL factors are implemented in lecture-based courses and laboratory-based courses. Therefore, future researchers are suggested to conduct a study in different methods such as a case study, open-ended question interviews or even a focus group study by visiting the same sampling frame in the present research. Such research will potentially validate the present study.

Additionally, as the present study is not longitudinal in kind, establishing the stage of adoption (e.g.: early, late) is not addressed. It is recognized, however, that the present research could provide a baseline for a future

researcher in this domain to ascertain the stage of adoption of PBL. Trends could then be reported.

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Appendix A

Human Subject Approval

R·I·T

Rochester Institute of Technology

RIT Institutional Review Board for the
Protection of Human Subjects in Research
141 Lomb Memorial Drive
Rochester, New York 14623-5604
Phone: 585-475-7673
Fax: 585-475-7990
Email: hmfsrs@rit.edu

Form C
IRB Decision Form

TO: Aezzaddin Aisyah Zainuddin

FROM: RIT Institutional Review Board

DATE: **April 7, 2017**

RE: Decision of the RIT Institutional Review Board

Project Title – The Adoption of Project Based Learning in Graphic Communication Programs

The Institutional Review Board (IRB) has taken the following action on your project named above.

☒ Exempt 46.101 (b) (2)

Now that your project is approved, you may proceed as you described in the Form A.

You are required to submit to the IRB any:

- **Proposed** modifications and wait for approval before implementing them,
- Unanticipated risks, and
- Actual injury to human subjects.

Heather Foti, MPH
Associate Director
Office of Human Subject Research

Revised 10-18-06

Appendix B

Pre-notice Email Prior to Survey

Subject: Survey for Graphic Arts Educators
Dear Graphic Arts Educator:

I am writing to ask for your help in an important study being conducted by Ms. Aezzaddin Aisyah Zainuddin, a graduate student at Rochester Institute of Technology (RIT) working on her thesis. This study is intended to gather timely, descriptive information about teaching methods used in graphic communications courses in post-secondary institutions.

You have been identified as an individual within a post-secondary educational institution who is knowledgeable about the teaching methods utilized. If another individual is better suited to respond, I kindly ask that you please forward this correspondence to them.

Your institution is an important in the delivery of graphic communications courses, and has been selected as a sample representative of such institutions. Therefore, your response is critical to the validity of the research. In next day or two, you will receive an invitation by e-mail to participate in this study by answering several internet-based survey questions. The purpose of this correspondence is because many people prefer notice prior to receiving a questionnaire.

This research depends on your generous assistance. As a thank you for your time, you will be offered an executive summary of the results of the study.

If you would like to change the contact information or have questions regarding the study, please email Ms. Zainuddin at az7536@rit.edu or call (585) 642-3900. You may also contact me as I am serving as one of Ms. Zainuddin's academic thesis advisors: my email is blmppr@rit.edu and my direct telephone number is (585) 475-5224. For questions regarding your rights as a participant in this study, you may contact Ms. Heather Foti, Associate Director of the RIT Human Subjects Research Office at hmfsrs@rit.edu or (585) 475-7673.

Thank you,

Bruce Leigh Myers, Ph.D.
Assistant Professor
School of Media Sciences
Rochester Institute of Technology
69 Lomb Memorial Drive
Gannett Building, 7-B 1155
Rochester, NY 14623-5603
Office Phone: 585-475-5224
Cellular Phone: 908-601-4646

Appendix C

Cover Letter Email and Survey Instrument

Dear Graphic Communications Educator:

As an individual who has been identified as an educator in the Graphic Communications field, you are invited to participate in a survey-based research study regarding the adoption of Project Based Learning in your curricula. This study is conducted by Aezzaddin Aisyah Zainuddin, as part of the requirements for the Master of Science degree at the School of Media Sciences in Rochester Institute of Technology (RIT).

There are no known risks or discomforts associated in the completion of the survey. The information obtained will potentially contribute to a greater understanding of the teaching methods utilized by educational institutions in their Graphic Communications courses. This information will potentially be of benefit to educators in the development of curricula moving forward. Please know that the data will be used exclusively for research purposes and will be reported in aggregate form only: your responses will be kept confidential and no individual responses will be disclosed in subsequent research reports. The survey should take no longer than 20 minutes to complete.

Furthermore, your decision whether to participate or not will not be identified and will have no effect on your relationship with RIT. You can withdraw from this study at any time without penalty. Although respondents will receive no financial compensation, your response is highly valued. As a token of our appreciation respondents may choose to obtain an executive summary of the results.

By clicking the below link and completing the survey, you indicate that you understand the above information and voluntarily agree to participate in this study.

Please follow this link to participate in the study: https://www.surveymonkey.com/r/PBLinGC

Should you have any questions about this survey, please contact the researcher, Aezzaddin Aisyah Zainuddin at (585) 642-3900 or via email at az7536@rit.edu. You may also contact the faculty advisor, Dr. Bruce Myers at (585) 475-5224 or blmppr@rit.edu . If you have questions about your rights as a research subject or if you feel you have been placed at risk, you may contact the HSRO Associate Director, Heather Foti at (585) 475-7673 or via email at hmfsrs@rit.edu .

Your participation in this study is highly valued and greatly appreciated.

Sincerely,

Aezzaddin Aisyah Zainuddin
School of Media Sciences
College of Imaging Arts and Science
Rochester Institute of Technology
69 Lomb Memorial Dr
Rochester NY, 14623
(585) 642-3900

Appendix D

Survey Questionnaire (Online)

Adoption of PBL in Graphic Communication Programs

Thank you for your participation in this research project.

You are asked to provide information based on your initial impressions of courses that you teach or are otherwise familiar. It is not the goal of the study to obtain carefully researched responses, there are no incorrect answers. The information collected will be used exclusively for research purposes and will be reported in aggregate form only; your responses will be kept confidential and no individual respondents will be identified in the subsequent research reports.

The survey should take no more than 20 minutes to complete. At any time and for any reason, you can refuse to answer a question or stop filling out the questionnaire by clicking on the "Exit" button on the upper-right corner of every page.

As a token of appreciation for your participation in this research survey, we would like to offer each participants an executive summary of the results.

Should you have any questions about this survey, please contact:

Aezzaddin Aisyah Zainuddin	**Researcher**	**(585) 642-3900**	**az7536@rit.edu**
Dr. Bruce Myers	**Faculty Advisor**	**(585) 475-5224**	**blmppr@rit.edu**
Heather Foti	**HSRO Associate Director**	**(585) 475-7673**	**hmfsrs@rit.edu**

Adoption of PBL in Graphic Communication Programs

Graphic Communication incorporates diverse fields which include traditional printing, digital printing, publishing, packaging, digital imaging, computer graphics, website development, cross media application, digital data management, digital photography, printed electronics, 3D printing and many more. Today, Graphic Communications courses generally emphasize one of the below content areas:

a. Graphic, Digital and New Media
b. Printing Technologies and Processes
c. Material and Sciences
d. Business Management and Entrepreneurship

This survey will also assess differences between Project Based Learning (PBL) implemented in lecture-based class and laboratory-based class. Lecture-based class is an instructional method that aid students with informed knowledge-content material, that focuses on key concepts, principles, or ideas of particular subject matter. In short, in lecture classes, students are exposed to the theoretical part of the learning. Laboratory classes are normally hands-on practical approach. Instructions are designed for students to be physically engaged with concepts in the field through active experimentation.

Adoption of PBL in Graphic Communication Programs

* Are you an instructor teaching courses in Graphic Communications, or otherwise familiar with Graphic Communications courses taught in your institution?

- ◯ Yes
- ◯ No

Adoption of PBL in Graphic Communication Programs

* What is your age?

- younger than 30 years old
- 30 - 34 years old
- 35 - 39 years old
- 40 - 44 years old
- 45 - 49 years old
- 50 years or older

* How many years of Graphic Communications industry experience do you have?

- < than 1 year
- 1 - 4 years
- 5 - 9 years
- 10 - 14 years
- 15 years or more

* How long have you been teaching or otherwise involved in Graphic Communications courses?

- < than 1 year
- 1 - 4 years
- 5 - 9 years
- 10 - 14 years
- 15 years or more

* What types of degrees are offered for Graphic Communications program at your institution. (select all that apply)

- [ ] Technical/Vocational training
- [ ] Associate degree
- [ ] Bachelor's degree
- [ ] Master's Degree
- [ ] Doctoral Degree

Adoption of PBL in Graphic Communication Programs

The following questions relate to Project Based Learning (PBL).

PBL is described as "…a systematic teaching method that engages students learning knowledge and skills through an extended inquiry process structured around complex, authentic questions and careful designed projects and tasks." Markham, Larmar, and Ravitz (2003). Often described as a student-centered teaching methodology, PBL approaches aim to enable conceptual understanding.

* Considering a particular lecture-based Graphic Communications course that you have taught, currently teach, or are otherwise familiar, which of the below topic areas best describes the primary focus of the course?

- [ ] Graphic, Digital and New Media
- [ ] Printing Technologies and Processes
- [ ] Material and Science
- [ ] Business Management and Entrepreneurship
- [ ] I am not familiar with a lecture-based Graphic Communications course at my institution

Adoption of PBL in Graphic Communication Programs

* Considering the same lecture-based Graphic Communications course, please indicate the level of relevance represented by the following statements.

"In this Graphic Communications course , students...

	Strongly Disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree
...are encouraged to engage in extended investigations"	○	○	○	○	○
...are required to inquire into a topic in depth"	○	○	○	○	○
...are taught what they would need to know before the project started"	○	○	○	○	○
...are required to use a planning form template to design projects"	○	○	○	○	○
...are required to use a driving question or problem statement to focus projects"	○	○	○	○	○
...are required to specify content standards that projects were designed to meet"	○	○	○	○	○
...are required to work in collaborative teams that employ the skills of group members when completing projects"	○	○	○	○	○
...are required to analyze and solve problems, think critically in in-depth and sustained way"	○	○	○	○	○
...are required to do a presentation of findings, results or conclusion for projects assigned"	○	○	○	○	○

	Strongly Disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree
…are required to present their work in front of an audience"	○	○	○	○	○
…are required to reflect on the quality of the project or their learning"	○	○	○	○	○

Adoption of PBL in Graphic Communication Programs

* Considering a particular laboratory-based Graphic Communications course that you have taught, currently teach, or are otherwise familiar, which of the below topic areas best describes the primary focus of the course?

- [ ] Graphic, Digital and New Media
- [ ] Printing Technologies and Processes
- [ ] Material and Science
- [ ] Business Management and Entrepreneurship
- [ ] I am not familiar with a laboratory-based Graphic Communications course at my institution

Adoption of PBL in Graphic Communication Programs

* Considering the same laboratory-based Graphic Communications course, please indicate the level of relevance represented by the following statements.

"In this Graphic Communications course , students...

	Strongly Disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree
...are encouraged to engage in extended investigations"	○	○	○	○	○
...are required to inquire into a topic in depth"	○	○	○	○	○
...are taught what they would need to know before the project started"	○	○	○	○	○
...are required to use a planning form template to design projects"	○	○	○	○	○
...are required to use a driving question or problem statement to focus projects"	○	○	○	○	○
...are required to specify content standards that projects were designed to meet"	○	○	○	○	○
...are required to work in collaborative teams that employ the skills of group members when completing projects"	○	○	○	○	○
...are required to analyze and solve problems, think critically in in-depth and sustained way"	○	○	○	○	○
...are required to do a presentation of findings, results or conclusion for projects assigned"	○	○	○	○	○

	Strongly Disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree
…are required to present their work in front of an audience"	○	○	○	○	○
…are required to reflect on the quality of the project or their learning"	○	○	○	○	○

Adoption of PBL in Graphic Communication Programs

The following questions are in regard to professional development of faculty in your institution in terms of course content, for example, learning about emerging technologies, equipment and software use.

* Does your institution support professional development for faculty in the form of funding?

- ◯ Yes
- ◯ No

* Does your institution support professional development for faculty in the form of release time?

- ◯ Yes
- ◯ No

* Does the Administration at your institution encourage professional development of faculty?

- ◯ Yes
- ◯ No

Adoption of PBL in Graphic Communication Programs

The following questions are in regard to professional development of faculty in your institution in terms of teaching methodologies, in other words, training and development that is not specifically course-content related.

* Does your institution support professional development for faculty in the form of funding?

- ◯ Yes
- ◯ No

* Does your institution support professional development for faculty in the form of release time?

- ◯ Yes
- ◯ No

* Does the Administration at your institution encourage professional development of faculty?

- ◯ Yes
- ◯ No

Adoption of PBL in Graphic Communication Programs

Please indicate your email address to receive the complimentary executive summary.

Thank you very much for taking part in this survey.

Appendix E

Reminder Email

Dear Graphic Communications Educator:

A few weeks ago, I sent you a survey regarding your opinions on the adoption of Project-Based Learning (PBL) in post-secondary institutions serving the graphic communications industry. I asked for your help with my graduate research because I believe you are a valuable part of the graphic communications education. This email serves as a reminder to complete the survey. I am entirely grateful for your help. If you have already completed the survey, I sincerely thank you for your response. To complete the survey, please click on this link: https://www.surveymonkey.com/r/PBLinGC .

Your participation is greatly appreciated!

Sincerely,

Aezzaddin Aisyah Zainuddin
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Rochester Institute of Technology
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