Integrative Learning: Helping Students Make the Connections

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Abstract

At the University of Michigan, research conducted with student leaders showed that even though most of these leaders reported having extraordinary learning experiences, the vast majority of them could not describe what they had learned, why or how it was valuable to them, or how they might apply their knowledge and skills. Through integrative learning, students can make meaningful connections of their experiences, synthesize their learning, and gain a greater understanding of how their skills and knowledge can help them achieve their academic, professional, and personal goals. This research explores the university's effort to facilitate integrative learning by engaging students in a curriculum focused on guided self-reflection.

Keywords: Integrative Learning, Student Learning, Learning Outcomes, ePortfolios, Reflection

Introduction

In his attention-getting book, *Excellent Sheep*, William Deresiewicz (2014) describes students at elite institutions as "smart and talented and driven, yes, but also anxious, timid, and lost, with little intellectual curiosity and stunted sense of purpose: trapped in a bubble of privilege, heading meekly in the same direction, great at what they're doing but with no idea why they're doing it" (p. 3). This perspective is not unlike the results of research conducted at the University of Michigan, where interviews with student leaders that demonstrated that, while most of these students reported having "extraordinary" learning experiences at UM, they were largely unable to describe what they had learned, why or how it was valuable to them, or how they might apply their knowledge and skills they had acquired at UM once they left the university (Pathways Report, 2006). In 2006, the University of Michigan formalized an institutional effort to address these issues by establishing a model of pedagogy and technology that helps students recognize and articulate what they have learned. Known as MPortfolio, this effort utilizes ePortfolio technology and a curriculum and pedagogy focused on self-reflection to foster integrative learning, a key learning outcome focusing on students' abilities to identify and connect their learning experiences and apply their learning to new situations.

Integrative Learning Defined

The literature on integrative learning consistently frames the discussion of the topic around the innate desire of humans to make connections and how this characteristic is central to intellectual and emotional development. Integrative learning is more than just making connections between different concepts or experiences; it also involves recognizing and evaluating the connections that we make (Huber, Hutchings, Gale, Miller, and Breen, 2007). The Association of American Colleges and Universities (AAC&U), which has been the

champion of integrative learning as an important postsecondary outcome, defines integrative learning as "an understanding and a disposition that a student builds across the curriculum and co-curriculum, from making simple connections among ideas and experiences to synthesizing and transferring learning to new, complex situations within and beyond the campus" (AAC&U, 2008, p. 1). By including synthesis as a component, this definition reflects a conception of integrative learning that requires individuals to do more than tacitly transfer knowledge and skills acquired from a previous experience to a new problem. This definition also recognizes that integrative learning is not limited to students' curricular experiences. Rather, integrative learning incorporates both curricular and co-curricular experiences and the connections and synthesis of learning from these experiences can then be applied as individuals face future challenges both within and outside of postsecondary education. Mentkowski and Sharkey (2011), when describing the development of AAC&U's definition of integrative learning, underscore its complexity by describing the multiple dimensions of relationships encompassed in integrative learning: relationships among past, present, and future learning; relationships between areas of study; and relationships between prior learning and new situations where it could be used.

Integrative learning has become an intriguing, if not critical, educational outcome that colleges and universities should aim to develop in students. Given students' propensities to learn from both their curricular and co-curricular experiences, by helping students make connections between, synthesize, and evaluate the knowledge and skills they have acquired through these varied experiences, we have the potential to create a whole that is greater than the sum of its parts. In a society that is increasingly demanding of individuals in both the workplace and in

civic life, it is important to educate college students so that they can adeptly face the complex challenges presented to them.

Theoretical Foundations of Integrative Learning

In order to understand integrative learning more deeply, it is helpful to review the underlying constructs that explain how individuals integrate learning. From its conception, integrative learning has been conceptualized as a multidimensional construct based on prominent theories of learning and development. Since the idea of integrative learning is still developing, there is ambiguity about the appropriate theoretical foundations. As a result, the conception of integrative learning and how to assess integrative learning are regularly up for debate.

Here, I focus on three theories that I feel best explain the processes that students go through as they demonstrate how they integrate learning. The first, transfer of learning, explains the process of connecting knowledge and skills acquired in a prior experience to new, different problems and situations. Definitions and descriptions of integrative learning frequently refer to the power of being able to make connections between different ideas and experiences. Transfer of learning is a cognitive activity based in the field of psychology that can explain how humans make connections between disparate phenomena. The study of transfer focuses on how people know and then apply their knowledge. Broadly, transfer is "the degree to which a behavior will be repeated in a new situation" (Detterman, 1993, p. 4). More specifically, when referring to transfer of learning, educational psychologists recognize it as an individual's use of past learning when he or she learns something new and his or her application of that learning to both similar and new situations (Haskell, 2001). Individuals regularly transfer their learning from one setting to another, frequently without realizing that they are doing it. Tacit transfer may be characteristic of transfer of learning, but it is not representative of integrative learning.

According to the conception of integrative learning that I am using in the present study, the transfer of learning from prior experiences to new, different settings is an explicit cognitive process. The second theory, reflective practice (Argyris & Schön, 1974; Schön, 1983; Schön, 1987), explains this distinction. At the core of reflective practice is the idea of tacit knowledge. Tacit knowledge refers to the things that an individual knows intuitively and remain unarticulated. Attributing the concept to Polanyi (1967), Argyris and Schön (1974) describe tacit knowledge as "what we display when we recognize one face from thousands without being able to say how we do so, when we demonstrate a skill for which we cannot state an explicit program, or when we experience the intimation of a discovery we cannot put into words" (p. 10). In all of these examples, there is a sense of knowing coupled with the failure to express what it is that one knows. It is not necessarily that this knowledge is ineffable, but rather that we have internalized this knowledge to the point that it is second nature. Reflective practice assumes that an individual's tacit knowledge is frequently inconsistent with the ideas that he or she expresses externally. Reflective practice is one's effort to make tacit knowledge explicit. Engaging in the introspection associated with reflective practice forces individuals to challenge their tacit assumptions and identify discrepancies between their thoughts and behavior. This process can lead to cognitive dissonance, which leads to the third theory, self-authorship.

Where transfer can explain the breadth of individuals' application of knowledge and skills to different situations, self-authorship can explain the depth that is required of individuals as they face complex problems. When cognitive dissonance occurs, individuals who may have previously taken perspectives at face value must now reassess diverse views when it is unclear what the correct answer may be. Self-authorship is a constructive-developmental theory, focusing on how individuals grow or change in the ways they make meaning (Kegan, 1994).

Observing that existing developmental theories inappropriately compartmentalized development into discrete domains, Robert Kegan introduced self-authorship as a concept that recognizes that the development of cognitive, intrapersonal, and interpersonal domains is interconnected. The cognitive (or epistemological) dimension of self-authorship examines the basis of our beliefs and poses the question, "How do I know?" Individuals in the early stages of cognitive development assume that knowledge is certain and see the world in black and white, right and wrong. As they develop, they begin to recognize the complexity of diverse perspectives and values, first acknowledging that varying perspectives exist and eventually being able to analyze and compare conflicting opinions to understand that different viewpoints are not necessarily equally valid (Perry, 1968). The intrapersonal domain focuses on one's identity and prompts the individual to answer the question, "Who am I?" Early intrapersonal development is characterized by a lack of awareness about one's own social identity (e.g., race/ethnicity, class, sexual orientation) and a lack of understanding about other cultures. As individuals develop intraculturally, they form an internal, personal identity that is distinct from the external identity that others project upon them and begin to recognize the legitimacy of other cultures (King & Baxter Magolda, 2005). The interpersonal domain explores our relationships by asking, "How do I relate to others?" It is in this domain that individuals must confront moral and ethical ambiguity. Development in the interpersonal domain spans from judgments and values based on external societal expectations, at the lowest level of development, to defining personal values based upon principles that one has determined internally, at the highest level of development (Kohlberg, 1976). In his book *In Over Our Heads: The Mental Demands of Modern Life*, Kegan (1994) argues that the expectations of today's society, in both the workplace and life at home, are overwhelming and individuals must develop more advanced ways of knowing in order to meet these high

expectations. Baxter Magolda (1998, 2001) applied this approach to human development to college students specifically. Based on multiple decades of research on the development of college students, she established a four-phase model of students' paths on the "journey toward self-authorship" (Baxter Magolda, 2001, p. 5).

Empirical Research on Integrative Learning

Peet et al. (2011) produced research that acts as a foundation for the present study. This study explores the relationship between the use of ePortfolios and the development of integrative learning at the University of Michigan. Using a pre-survey/post-survey design, the researchers had students self-report their integrative learning ability by indicating their level of agreement with 37 statements in 12 categories. Factor analysis was used to categorize these 37 items into 6 dimensions of integrative learning. On average, students demonstrated significant gains across all six factors from the pre-survey to the post-survey. These gains were consistent across all groups of students as there were no significant differences based on class year, gender, race/ethnicity, and survey year. Where there was a difference that was both statistically and practically significant was that gains were pronounced among students who participated in more than one MPortfolio course or program. Additionally, there were differences based on academic field. Students in the natural sciences experienced the greatest gains in demonstrating knowledge gained within and across specific contexts, recognizing and adapting to differences, understanding and directing oneself as a learner, and identifying and discerning their own and others' ethics and perspectives. Humanities students, on the other hand, gained the most in becoming reflexive, accountable, and relational learners. The consistent and broad gains provide compelling evidence that ePortfolios contribute to the development of integrative learning. The authors recognized that the study was merely "the first step within a much larger research effort

that is focused on developing theory, identifying best practices, and creating effective assessment instruments for fostering integrative knowledge and lifelong learning across a wide range schools, disciplines and institutions" (p. 21).

Integrative learning has become a part of multiple large-scale studies. Notably, the National Survey of Student Engagement (NSSE) includes a set of questions related to integrative learning in its DEEP Learning section (Documenting Effective Educational Practice). In this section, students are asked how often they engaged in a variety of activities during the most recent academic year. The section includes questions related to the application of knowledge and skills from different contexts to new situations (e.g., working on a paper or project that required integrating ideas or information from various sources, putting together ideas or concepts from different courses when completing assignments or during class discussions). Consistent with AAC&U's statement on integrative learning, one item addresses whether students utilize diverse and contradictory points of view: including diverse perspectives (different races, religions, genders, political beliefs, etc.) in class discussions or writing assignments. Finally, two questions focus on whether students extend their curricular learning beyond the traditional confines of the classroom (i.e., discussing ideas from readings or classes with faculty outside of class; discussing ideas from readings or classes with others outside of class). The survey prompts students to indicate the frequency of these activities on a four-point scale, ranging from "very little" to "very much." These questions have also been utilized in the Wabash National Study of Liberal Arts Education. These are both large, multi-institutional studies and each has presented conclusions about integrative learning in peer-reviewed journals and for the improvement of academic programs at the institution level.

Multiple studies utilizing NSSE data include integrative learning as an outcome. The first of these studies sheds light on how integrative learning is associated with other collegiate outcomes and whether these relationships vary based on academic discipline (Nelson Laird, Shoup, Kuh, and Schwarz, 2008). Using data from both NSSE and the Faculty Survey of Student Engagement (FSSE), the authors found a positive relationship between engagement in integrative learning activities and personal and intellectual development, student satisfaction, and grades. Regarding differences by discipline, both seniors and faculty reported that there was significantly less engagement in integrative learning activities in hard fields (e.g., biology, mathematics, medicine) compared to soft fields (e.g., psychology, history, economics). Exploring differences based on discipline in the relationship between engagement in integrative learning activities and other outcomes, differences in personal and intellectual development tended to be minimal; the one significant difference was that the positive relationship between integrative learning and personal and intellectual development was significantly greater for students in hard applied life fields compared to those in the hard pure non-life fields. Differences based on discipline were more pronounced for the other outcomes, satisfaction and grades. The relationship between engagement in integrative learning activities and student satisfaction was strongest for students in the hard applied non-life fields. For grades, the relationship was strongest for students in the soft pure life and soft pure non-life fields. Nelson Laird and Garver (2010) built upon the previous study by introducing an additional dimension, whether there is variation between general education courses and non-general education courses. Holding all else constant, faculty teaching general education courses emphasized integrative learning, on average, significantly more than faculty teaching non-general education courses and that there were significant differences based on discipline, particularly for hard applied life fields. The authors recommend

that faculty and administrators take into account disciplinary contexts when engaging in curriculum reform, particularly as they consider general education courses. In another study resulting from the NSSE survey, Zhao and Kuh (2004) found that, for both first-year students and seniors, there was a significant positive relationship between experience in a learning community and academic integration.

Based on data collected through the Wabash National Study of Liberal Arts Education, which uses the same scale as NSSE, Mayhew, Seifert, Pascarella, Nelson Laird, and Blaich (2011) explored the relationship between deep learning approaches and students' moral reasoning at the end of the first year. Controlling for student background, pre-college factors, and first-year coursework there was a significant positive relationship between engagement in integrative learning activities and moral reasoning. For the other deep approaches, higher-order learning and reflective learning, the relationships with moral reasoning were not statistically significant. Aside from this study, the relationship between integrative learning and moral reasoning is one that is largely unexplored. However, the results support one finding about interpersonal development that was previously generated through research at Alverno College. Mentkowski and Associates (2000) found, through student interviews, that students at Alverno developed an appreciation of differing values because they were consistently asked to examine and discuss them across multiple contexts. While this study provides evidence that a relationship between integrative learning and moral reasoning exists, even after controlling for other deep approaches, the authors provide little insight into the mechanisms that theoretically explain this relationship other than that a relationship should plausibly exist.

Barber (2012) used longitudinal qualitative data gathered in the Wabash National Study of Liberal Arts Education to investigate integration of learning. He analyzed interviews with 97

students at liberal arts colleges with the goal of understanding how college students connect knowledge and experiences and so that educators can more intentionally promote the integration of learning. Through this analysis, he found that there were three distinct types of integration. The first, establishing a connection, is characterized by the discovery of similarities between ideas though the ideas remain distinct. In this category, students compare and contrast, use analogies and similes, and make connections between concepts. The second type, application across contexts, is characterized by the use of knowledge from one context in a different context. This type of integration often appeared when students described how they used skills or knowledge that they acquired in high school in collegiate settings. The third type, synthesis of a new whole, is characterized by the creation of new knowledge by combining insights. Students who exhibited this type of integration used language such as "incorporate," "adapt," "collaborate," and "interpret." The students in the study most frequently fell into the second category, application across contexts, and Barber also found that students were more likely to demonstrate synthesis in the second year of the study compared to the first.

In another paper based on the data collected through the Wabash Study, Barnhardt, Lindsay, and King (2006) used a mixed-methods approach to improve our understanding of how college students integrate learning. For the quantitative analysis, the researchers constructed a seven-item scale to serve as a measure of integration of learning. This scale was comprised of items similar to those in the five-item NSSE integrative learning scale and there are two items that appear on both scales. The scales differ in that the NSSE scale has a stronger emphasis on discussions, with the assumption that discussing ideas inside and outside of the classroom is an indicator of integration of learning. The scale utilized in this study does not emphasize discussions but rather includes items that directly address the connections students make from

different experiences. It also includes one item goes beyond the behaviors of students and the connections that they make and addresses the highest order of integrative learning (according to the AAC&U VALUE rubric): synthesizing and organizing ideas, information, or experiences into new, more complex interpretations and relationships. The results of the analysis revealed that interventions such as experience in a learning community, diverse interactions, and integrative assignments were significantly and positively associated with integration of learning. Additionally, sociocultural values and intercultural values and attitudes were also significant, positive predictors of integration. A student's class year was also a strong predictor of his or her level of integration. The qualitative results of the study generally supported the quantitative findings. In particular, the interview data brought to life the considerable differences based on class year, with seniors demonstrating the most evidence of integration.

A recurring theme in the empirical literature on integrative learning is that educators can create settings and interventions that may effectively facilitate integrative learning. Melendez, Bowman, Erickson, and Swim (2009) explored the impact of one intervention, a short-term multidisciplinary problem-solving experience at the United States Military Academy, on students' capacity to integrate learning. This experience was seven days long, incorporated multidisciplinary activities, and explicitly focused on the connections between mathematics and biology. The goal of this effort was "to create an integrative learning experience (ILE) that better prepared our students to respond effectively to the uncertainties of a changing technological, social, political and economic world" (p. 132). The authors noted that students generally had a positive experience, though there was no evidence of whether the intervention resulted in the enhancement of students' integrative learning or any other educational outcomes. Faculty indicated that the experience was initially unsettling, as they were forced to approach

their teaching in a new way. However, they quickly adapted and, in the end, reported that the experience was positive. While this article did not provide quantitative evidence supporting the experience, it is a good example of the types of interventions that colleges and universities can pilot as they try to facilitate integrative learning.

ePortfolios in Action on the University of Michigan Campus

In 2006, the University of Michigan formalized its institutional effort around ePortfolios with the MPortfolio project. A joint effort of the Division of Student Affairs and the Office of the Provost, MPortfolio was established with the aim of fostering integrative learning in order to help students recognize and articulate what they have learned during their time at the University of Michigan. Portfolio work has long existed at the University of Michigan within a diverse set of academic units, each with its own unique set of learning outcomes. Some units use portfolios as tools for assessing hard skills, while others employ portfolios that are professionally focused. For example, the Sweetland Writing Center requires students in the Writing 220 course to complete ePortfolios that encourage students to reflect on their work so that they improve their writing skills. Professional portfolios, such as the ones that the School of Education uses for its aspiring teachers, act as a showcase of student work that they can use to demonstrate their skills, abilities, and experiences to potential employers. A third type of ePortfolio, the integrative learning portfolio, compels students to reflect on their disparate experiences (e.g., coursework, co-curricular activities, key personal events) so that they gain a greater understanding of their skills, knowledge and values and can articulate a personal philosophy statement. Some academic units incorporate a hybrid model in their portfolio work. For example, the School of Information utilizes an integrative learning portfolio as part of its professionally-oriented Practical Engagement Program (PEP), which enrolls master's students participating in credit-based

internships, and students in the School of Dentistry must create an ePortfolio that requires students to reflect and draw connections between their coursework and real world experiences as well as monitor the competencies that they are expected to develop through the programs. The common thread that runs throughout each of these types of portfolio work is that it encourages students to grow through self-reflection.

The Division of Student Affairs (DSA) at the University of Michigan has embraced integrative learning as a desired outcome of undergraduate students at the institution. By developing integrative learning in students, DSA expects that students will be able to make meaningful connections of their experiences, synthesize their learning, and gain a greater understanding of how their skills and knowledge can help them achieve their academic, professional, and personal goals. As a champion of integrative learning on campus, DSA has been instrumental in promoting integrative learning as "a process for synthesizing learning across multiple experiences, coalescing meaning, and also creating new learning and meaning" (Taylor, 2011).

Empirical Research on ePortfolios

In addition to the aforementioned study by Peet et al. (2011), several other studies have explored the impacts of the use of ePortfolios on student outcomes in postsecondary education, though these studies have been especially lacking in academic rigor. Desmet, Church Miller, Griffin, Balthazor, and Cummings (2008) conducted the most rigorous of these studies and found that, when used to support writing instruction, the use of ePortfolios was correlated with an overall mean increase in the quality of essays, though about a quarter of the students saw declines in quality of their essays. In a similar study focused on secondary students transitioning into higher education, Acker and Halasek (2008) found that student writing improved between

the initial draft and the final essay, but they attributed student gains to the quantity and quality of feedback rather than the ePortfolio technology itself. They proposed that it was a useful tool for structuring the learning environment and facilitating the feedback and rewriting processes. Neither of these studies used a control group. There were two other studies that tied student achievement to the use of ePortfolios, but these studies were more descriptive in nature. Crawford (2003) reported that, based on early anecdotal results of ePortfolio implementation at Hocking College in Ohio, the use of portfolios is positively associated with gains in communication skills. Cambridge (2008), in a descriptive article on the use of ePortfolios at George Mason University, indicated that portfolio assessment has been useful in helping students achieve the nine core competencies expected of students in the institution's New Century College, though the article did not report to what extent and in what ways portfolios influenced student achievement.

Research Questions

The overarching question addressed by this research is: *To what extent do ePortfolios facilitate the development of integrative learning?* Accordingly, all of the research conducted in this study is designed to answer this central research question. Using a pre-/post-survey design, I investigate whether students' integrative learning ability changes between the start and the end of the process of developing a reflective ePortfolio. In addition to aiding the program evaluation efforts of MPortfolio, I expect that answering this research question will result in contributions to both the body of literature exploring the influence of assessment on student achievement and also the emerging body of literature on integrative learning.

In order to organize the research in a manageable way and to develop a more fully formed understanding about specific aspects of MPortfolio, a series of sub-questions will guide

the inquiry proposed in the overarching research question. The goal of the first sub-question (*"What is the causal impact of ePortfolio use on students' integrative learning?"*) is to determine whether the relationship between engagement in a reflective ePortfolio process and integrative learning is causal. In other words, can one plausibly attribute the development of integrative learning to this particular experience rather than all of the other curricular, co-curricular, social, and personal things happening in the lives of college students? Previous research at the University of Michigan has demonstrated that students experience positive changes in integrative learning over the course of the MPortfolio experience (Peet et al., 2011). However, without a control group, this research does not demonstrate whether the gains associated with MPortfolio are any different from the changes that the students may have experienced without engaging in the MPortfolio process.

Finally, the purpose of the second sub-question (*"Does the development that students experience persist beyond their initial experiences using ePortfolios?"*) is to determine whether the learning that students experience through the MPortfolio process stays with them years after the initial experience or whether it fades away over time. The research design employed in this study is a pre-/post-survey design, with surveys administered at the start of the process and again at the end. With this design, it provides evidence about how students change over the course of the experience but does not demonstrate whether students retain what they learn beyond this experience. The present study also includes a follow-up survey two years after the completion of the experience to determine whether the changes persist. This has the potential to be a compelling contribution to the research since implicit in the integrative learning outcome of this study are habits of mind that students should carry with them through their lives.

Conceptual Framework

Though Banta (2002) found that assessment practitioners frequently approach their work without utilizing a theoretical framework, there is a vast collection of theories that can guide assessment efforts. I review two theories that I believe are especially applicable for understanding how ePortfolios, and the MPortfolio process specifically, can contribute to integrative learning. First, I describe and critique Astin's (1970a, 1970b, 1976, 1993) input-environment-output (I-E-O) model, which is frequently used in higher education research to understand how institutional environments influence the outcomes of students. Second, I describe how Kolb's (1984) Experiential Learning Theory explains how the reflective processes of MPortfolio can contribute to student learning.

Banta (2002) conducted an informal poll of colleagues and found that, although most campuses did not employ a conceptual framework to guide their assessment efforts, those who did were likely to have implemented Astin's Input-Environment-Outcome (I-E-O) model. Based on organizational input-process-output (I-P-O) models, the I-E-O model is a traditional systems model that identifies the system's inputs and outputs and the processes that the inputs go through in order to be transformed into the outputs. In the case of Astin's model, the inputs refer to student demographic characteristics, family background, and pre-college academic and social experiences. The environment includes the various programs, policies, cultures, faculty, peers, and experiences that students encounter while they are in college. Outcomes, as described in the introduction, encompass students' knowledge, skills, attitudes, values, and behaviors at the completion of their studies and beyond. According to the model (illustrated in Figure 1), inputs both shape outcomes directly and influence outcomes indirectly through the ways in which students engage with the campus environment. Astin's model takes a value-added approach,

defining a student's change or growth during college as a comparison of his or her outcome characteristics with his or her input characteristics. Astin (1993) explains that "the basic purpose of the model is to assess the impact of various environmental experiences by determining whether students grow or change differently under varying environmental conditions" (p. 7). Studying the impact of a college education with the I-E-O model can help faculty, administrators, and policy makers identify the programs and policies that best serve students in their achievement of educational outcomes.

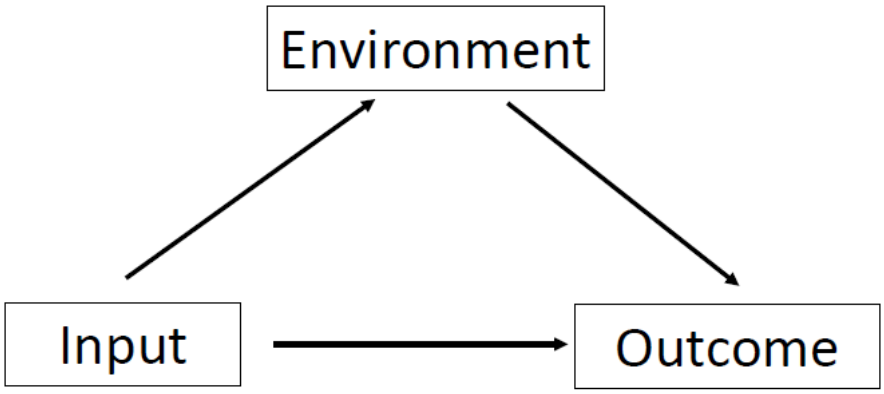

Figure 1: Input-Environment-Outcome (I-E-O) Model (Astin, 1970a, 1970b, 1977, 1993)

Astin's I-E-O model explains how an institutional environment, broadly, can influence student outcomes. Assessment is a feature of the institutional environment, though it is merely one of many aspects of the environment that students experience during their time at the college. The second theory that I present as a way to explain how assessment can influence student achievement is more directly focused on how ePortfolio assessment, and the MPortfolio process in particular, can contribute to integrative learning. To put it succinctly, MPortfolio is a process that encourages students to reflect upon their experiences so that they have a greater

understanding of themselves. While the ePortfolio tool is integral to MPortfolio, the process relies at least as much on the curriculum and pedagogy that guide it. At the heart of all three of these components – pedagogy, curriculum, and the ePortfolio tool – is reflection. The curriculum consists of a series of exercises aimed at having students reflect upon their experiences so that they are able to identify their knowledge, skills, and values, understand how the experiences that have developed their knowledge, skills, and values are connected, and be able to apply what they have learned to new settings. The pedagogy, facilitated by faculty, staff, or peers, provides scaffolding and guides the reflective process. Recognized as a reflective tool, the ePortfolio technology allows students to organize and reflect upon their experiences and then highlight what they have learned through the process.

Nearly a century ago, John Dewey (1916) established a link between reflection and learning, positing that reflection is a critical part of the learning process. To paraphrase Dewey, we do not learn from experience; it is by reflecting on our experiences that we learn. Dewey (1933) defines reflective thought as "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends" (p. 6). Rogers (2001), reviewing and synthesizing prominent conceptualizations of reflection, proposes that reflection is:

> a cognitive or affective process or activity that (1) requires active engagement on the part of the individual; (2) is triggered by an unusual or perplexing situation or experience; (3) involves examining one's responses, beliefs, and premises in light of the situation at hand; and (4) results in integration of the new understanding into one's experience. (p. 41)

Further, Rogers posits that the ultimate intent of reflection is to integrate the understanding one has gained from his or her experiences so that he or she can make better choices or actions and enhance his or her overall effectiveness. Kolb's (1984) Experiential Learning Theory is a useful way to conceptualize how the reflective activities of the MPortfolio process could facilitate student learning. Building off the work of Dewey, Kurt Lewin, and Jean Piaget, Kolb developed a cyclical four-component model that aims to explain how individuals learn from their experiences. According to Experiential Learning Theory, learning is defined as "the process whereby knowledge is created through the transformation of experience" (p. 38). Accordingly, while Kolb's model can begin at any one of its four points, it is helpful to conceptualize its start with the concrete experiences that individuals have at the start of the learning process. During the second step of the model (reflective observation), individuals make observations about and reflect upon these concrete experiences. In the third step (abstract conceptualization), individuals learn from the experience by forming abstract concepts and generalizations. It is during this step that individuals make connections, conscious or subconscious, between actions and the effects of these actions. In the fourth step (active experimentation), individuals apply what they have learned by testing the implications of these concepts in new situations. The cycle returns to the first stage as individuals have new experiences in which they have applied what they have learned through the process. Figure 2 illustrates this cycle.

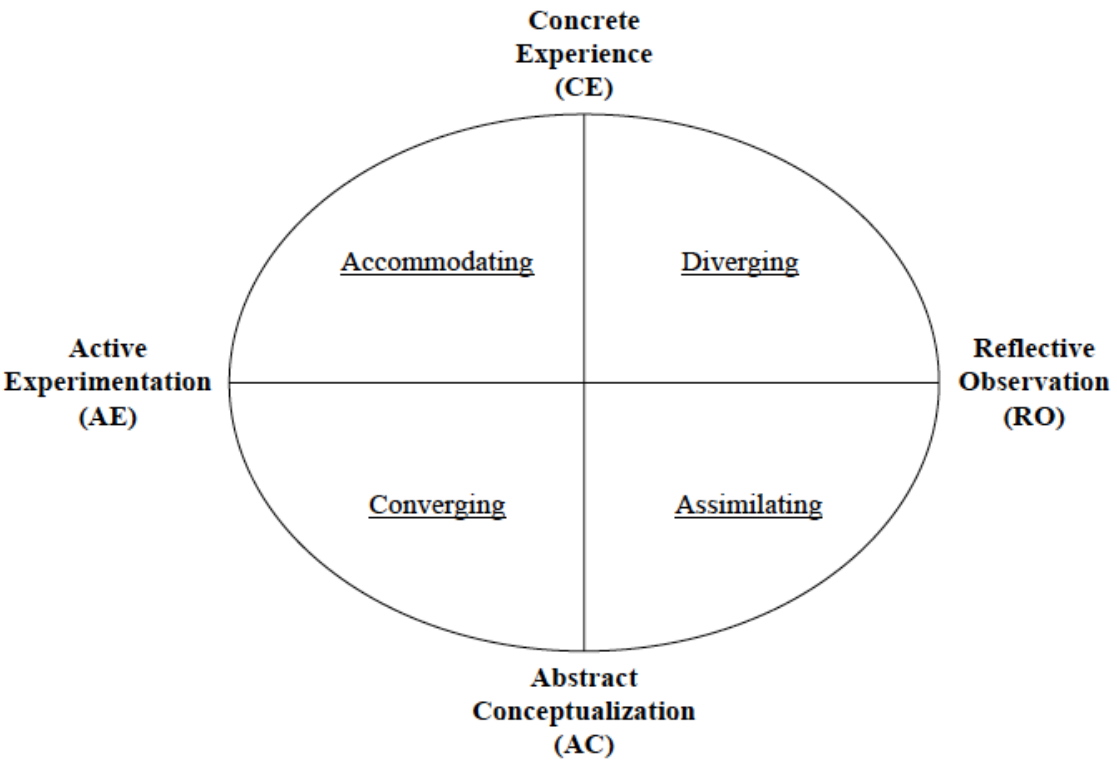

Figure 2: The Experiential Learning Cycle and Basic Learning Styles (Kolb, 1984)

This theory is particularly helpful in understanding how students who go through reflective ePortfolio processes can transform the experiences they have at the beginning of the experience to a deeper understanding of themselves at the end. Through the process at the University of Michigan, students are typically asked to identify experiences that are important to them and then reflect on these experiences to develop new knowledge by recognizing what is meaningful about these experiences. For example, when developing a personal Philosophy Statement, students are asked to describe experiences during which they felt "deeply engaged or purposeful." Reflecting on their observations about these important experiences, they are then asked to identify themes so they can identify the meaningful aspects of these experiences. An anecdote that has been compelling to practitioners engaged in this work on the University of Michigan campus is that feedback from employers to Career Services has indicated that students

would receive an A-plus on their resumes but are failing their interviews. On their resumes, they have accumulated a strong collection of concrete experiences; however, they have difficulty articulating what is meaningful about these experiences when they meet with employers. The process of developing an ePortfolio helps students go from being able only to cite these concrete experiences to being able to describe the skills and knowledge they have developed through their experiences, how these experiences relate to each other, and how they can apply what they have learned to new settings. Additionally, by teaching students how to reflect and encouraging them to continue to use their ePortfolios as a tool for reflection, students learn to take their newly developed knowledge and begin the cycle again.

Data & Methods

Since 2009, research on integrative learning at the University of Michigan has employed a longitudinal survey design to determine how students' abilities to integrate their learning change. Over this period, 1,600 students completed a baseline pre-survey at the start of the MPortfolio process and a post-survey at the end. The main instrument used in this study is the Integrative Learning Self-Assessment. This survey instrument is based upon the AAC&U integrative learning VALUE rubric and has been utilized in MPortfolio research efforts since 2009. A team of researchers at the University of Michigan, comprised of Simone Himbeault Taylor, Malinda Matney, Patricia Gurin, Melissa Peet, Steve Lonn, and Tiffany Marra, designed the Integrative Learning Self-Assessment to measure the conceptual dimensions of integrative learning. When administered at different points in time, this self-assessment allows researchers to measure the changes that students experience in multiple dimensions of integrative learning over the course of a learning experience. The core of the survey is composed of 37 statements in 12 categories with which students are asked to indicate their level of agreement on a five-point

Likert scale (from "strongly disagree" to "strongly agree"). Two years later, a group of students responds to a follow-up survey to determine whether changes persist beyond the initial experience. The research also includes a delayed-treatment, control group design that can determine whether there is a causal relationship between engagement in the process and integrative learning. The pre-survey response rate has been 85% and the post-survey response rate has been 80%. Matching the pre-survey responses to the post-survey responses, the overall matched response rate is 71%. The response rate for the follow-up survey was 30%, considerably lower though reasonable given that the students' distance from the initial MPortfolio experience and that quite a few students had already graduated and were no longer on campus.

The pre-/post-survey design of the study aims to measure how students change over the course of the MPortfolio process. Students commence the process with a set of background characteristics and experiences. Since the MPortfolio is an inductive learning process that focuses on students' reflections on their identity and experiences, it is assumed that the background characteristics and experiences they bring to the process are elements that are critical to integrative learning through MPortfolio. The pre-survey, administered when students begin the process, serves a baseline measure of integrative learning. After engaging in the MPortfolio process, students complete the post-survey, which is the source of the dimensions of integrative

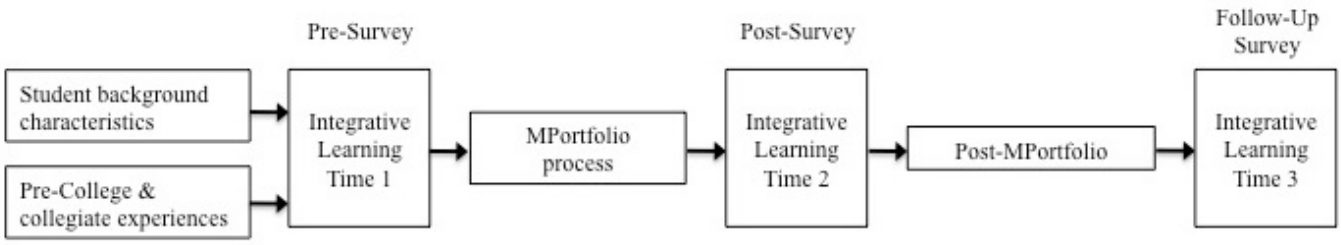

Figure 3: Conceptual Model of Correlational Research Design

learning that serve as the intended outcomes of the process. Beginning during the 2012-13 academic year, students who engaged in MPortfolio through the Division of Student Affairs two years prior completed a follow-up survey to determine how students' integrative learning ability changes beyond the immediate MPortfolio experience and whether they continue to engage in the reflective activities they learned through the process and if they continue to update and utilize their ePortfolios. Data from these three surveys comprise the data set for the current study. Figure 3 is a model of the research design that provides a visualization of the timing and elements of the study.

The goal of this design is to demonstrate how students change throughout this process. However, without a control group of students who have not engaged in MPortfolio, it is impossible to determine whether the changes that students potentially experience are different from the development that college students might otherwise experience without going through this process. In order to determine whether integrative learning can be attributed to the MPortfolio process, it is necessary to determine how students who engage in the process develop differently from equivalent students who do not

In order to determine the causal impact of MPortfolio on integrative learning, it is necessary to compare students who engage in the process (the treatment group) to a group of students that is essentially the same but do not engage in the MPortfolio experience (the control group). It is not enough to compare these groups on observable characteristics such as gender, race, major, or grade point average. Such a design can suffer from omitted variable bias. For example, the fact that students elect to participate in MPortfolio may be indicative of a greater level of motivation compared to students who do not participate. Thus, it is possible that this difference in motivation could explain any observed differences in integrative learning. To make

a compelling causal claim, it is important to eliminate such threats to validity by minimizing the differences between the treatment and control groups for both observable and unobservable characteristics.

The gold standard for causal research is a randomized controlled trial (RCT), an experimental design in which a group of subjects is randomly divided into a treatment group and a control group. These two groups are the same with the one exception that the treatment group receives the treatment (in this case, engagement in MPortfolio) and the control group does not. It has not been possible to arrange for an RCT to determine the effect of MPortfolio, since the institutional leaders who are responsible for it do not want to exclude interested students from the process. In the absence of an RCT, I employ a design that assigns students to treatment and control groups, minimizes omitted variable bias, and allows all students who are interested in MPortfolio to engage in the process.

The causal component of this research includes only the students who engage in MPortfolio through the Psych 322: First-Year Experience course. Offered in both the Fall term and the Winter term, first-year students engage in this 1- or 2-credit course in a residence hall-based, peer-facilitated experience over 6 weeks. The fact that this course is offered both in the Fall and the Winter allows for the possibility to utilize a delayed treatment, control group research design. Figure 4 provides a visualization of this research design. In this design, the students who participated in the course during the Fall term serve as the treatment group, while those who participated during the Winter term serve as the control group during the Fall term (prior to their own participation). Students in the Fall course completed the pre-survey and the post-survey according to the standard Fall survey administration schedule (at the start of the experience in October and again at the end in December). Students in the Winter course cohort

completed a pre-survey when the Fall course began and, when they enrolled in the course during the Winter term, they completed the pre-survey again at the start of the experience in January and the post-survey at the end of the experience in March. This design allows me to compare a group of students who have selected into the MPortfolio process and engage during the Fall term to a group of students who also select into MPortfolio but do not participate in the Fall. Using two groups who select into the process minimizes the omitted variable bias associated with selection differences. One could argue that the two groups are inherently different because one group has chosen to participate in the Fall and, for some unknown reason, the other group has decided to put off its engagement until the Winter. However, the main reason why one group

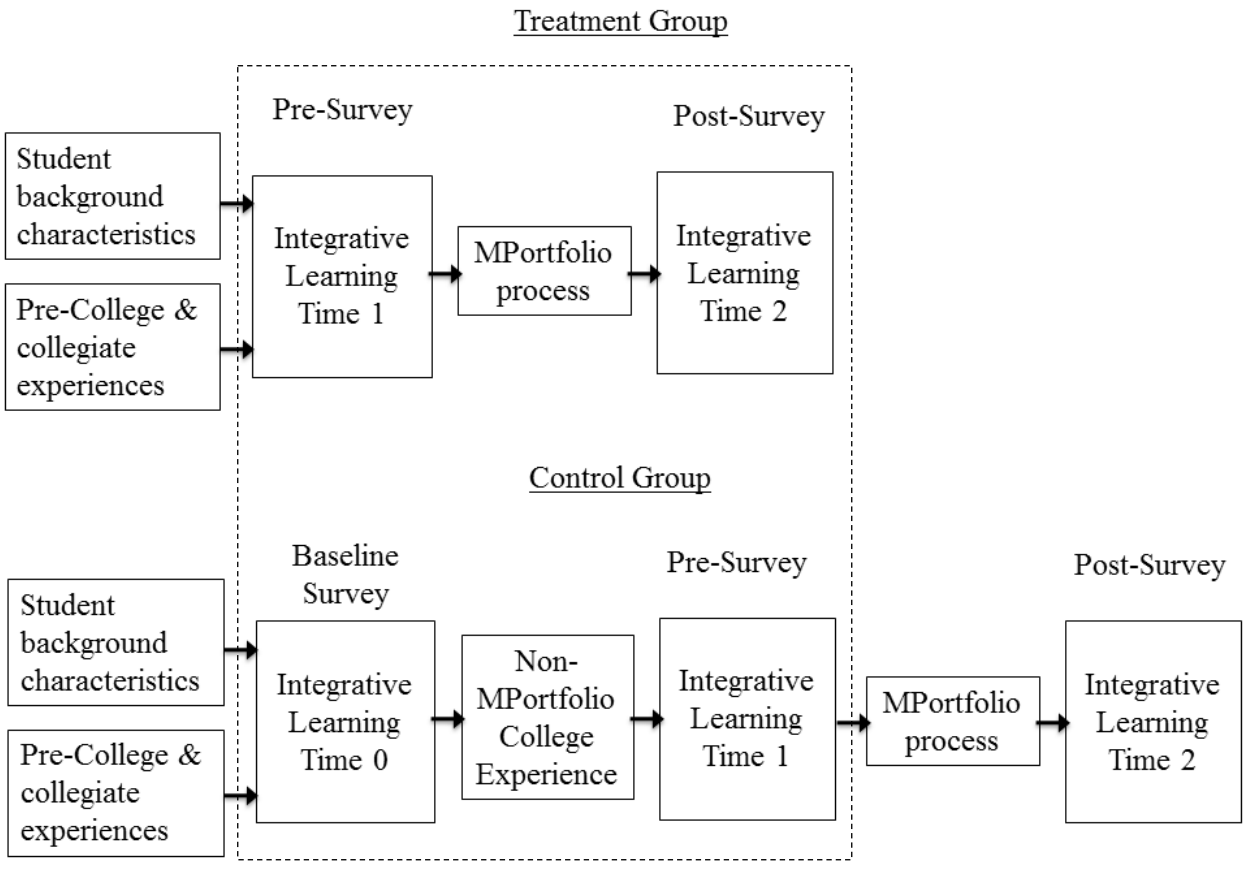

Figure 4: Conceptual Model of Causal Research Design

participates in the Fall and the other participates in the Winter is based on the Resident Advisor who leads the process. Some of the Resident Advisors choose to lead the process in the Fall, while others choose to do so in the Winter. Since the students are randomly assigned to both their residence halls and their Resident Advisors, whether they participate during the Fall or the Winter appears to be unrelated to the integrative learning outcome.

To reduce the 37 survey items into a smaller set of dimensions of integrative learning, I conducted exploratory factor analysis using principal component analysis and varimax rotation with Kaiser normalization. Based on evaluation of Eigenvalues (greater than 1) and visualization of the scree plot, I identified five factors that explain 60% of the variance. After exploring how each factor and the items that loaded highly on each factor aligned with the theoretical constructs of integrative learning, I named each factor: 1) Identify knowledge, skills, and values, 2) Provide evidence of knowledge, skills, and values to others, 3) Recognize and adapt to differences in order to create solutions, 4) Work with others to identify and address complex problems, and 5) Develop a professional digital identity. I then computed composite scores, or scales, based on the mean of the items that had their primary loadings on each factor. These scales, which I refer to as dimensions of integrative learning, include all 37 survey items and each item is unique to a particular dimension of integrative learning. Dimensions include items with factor loadings of at least .42. Each dimension of integrative learning had a high level of reliability, as evidenced by Cronbach's alpha values exceeding .80.

The first dimension of integrative learning is *Identify knowledge, skills, and values*. The common theme that appeared in this dimension's items is students' abilities to identify what they have learned—knowledge, skills, values, passions, interests, strengths, etc. This ability to identify what one has learned is a product of the reflective process that transforms tacit

knowledge to explicit knowledge. Through this greater understanding of oneself, a student can recognize how his or her beliefs and values inform his or her life, recognize the strengths and weaknesses he or she brings to learning and work situations, and explore the ways in which he or she can enhance these strengths or address these weaknesses. Recalling the AAC&U VALUE Rubric for integrative learning, identification is a benchmark level of performance (the lowest level out of four ordered categories of performance): "Identifies connections between life experiences and those academic texts and ideas perceived as similar and related to own interests" (AAC&U, 2009, p. 2).

The second dimension builds upon identifying knowledge, skills, and values to being able to *provide evidence of knowledge, skills, and values to others*. This dimension consists of 12 items, so it encompasses a broad range of student abilities. While the items in this dimension feature a variety of student outcomes and activities (e.g., personal values and beliefs, knowledge and skills, learning from and working with others) within and across specific contexts, the common thread across the items is the student's ability to demonstrate what he or she has learned. Eleven of the dimension's 12 items include either "provide evidence" or "demonstrate" in the item's language. The AAC&U Integrative Learning VALUE Rubric explicitly addresses the ability to demonstrate integration in a criterion called "Integrated Communication." At the most basic level, students should have the capacity to complete the assignment in "an appropriate form." However, for students to exhibit higher levels of performance, their demonstration of integration should explicitly connect content and form and purposefully enhance meaning for the audience.

The third dimension, *Recognize and adapt to differences in order to create solutions*, emphasizes students' understanding about how identity shapes their worldview and the

opportunities and challenges associated with working with people different from oneself. This dimension of integrative learning demonstrates the relational emphasis of the Integrative Learning Self-Assessment. The dimension represents the interpersonal and intrapersonal domains of self-authorship and recognizes that integration is not merely the connection of ideas and experiences; accounting for context and understanding how one's learning connects to their own perspectives and the perspectives of others are qualities that are critical for addressing complex problems in the 21st century.

The fourth dimension, *Work with others to identify and address complex problems*, builds upon the previous dimension. Once a student recognizes the importance of understanding context and how individuals' perspectives are informed by their backgrounds and experiences, can he or she then work with others to identify and address complex problems? This dimension includes a variety of activities related to working with others to solve problems: collaboratively identifying problems and developing plans and taking action to address the problems, taking into account the needs and perspectives of all group members, being mindful of the ways in which other group members are engaging, and seeking feedback from others.

The fifth dimension, *Develop a professional digital identity*, is similar to the second dimension (*Provide evidence of knowledge, skills, and values to others*) in that it highlights the importance of being able to provide evidence of integration in a coherent and meaningful way. Consisting of only 3 items, this dimension includes developing and continually updating a professional identity online (i.e., through an ePortfolio or personal website) that demonstrates one's knowledge, skills, and values. Additionally, one item in this dimension specifies that this online professional identity should be different from one's personal Facebook account.

To analyze the data, I employ two main analytic approaches. First, I use paired-samples t-tests to explore change from the pre-survey to the post-survey. Second, I use repeated measures ANOVAs to determine the treatment effect and long-term impact.

Results

First, I address the overarching research question of the study, *to what extent do ePortfolios facilitate the development of integrative learning?* In order to understand whether engagement in the MPortfolio process is associated with integrative learning, I have performed a series of paired samples t-tests on the overall sample of students who engaged in MPortfolio and completed both the pre-survey and the post-survey. This procedure demonstrates whether the mean post-survey dimensions of integrative learning are significantly different from the equivalent means from the pre-survey. In other words, on average, do students experience significant changes in the dimensions of integrative learning from the start of the MPortfolio process to the end?

Table 1 presents the mean values for each dimension of integrative learning from both the pre-survey and the post-survey, as well as the difference between these two values. Additionally, the table indicates whether these mean differences are statistically significant and the effect sizes of the changes. The results of the paired samples t-test suggest that, on average, students who engage in MPortfolio experience significant positive changes across all five dimensions of integrative learning. Based on the effect size values, gains ranged from fairly small to moderate. Students most improved their ability to provide evidence of knowledge, skills, and values to others (Cohen's d = .539), while the smallest gains were related to students' ability to recognize and adapt to differences in order to create solutions (Cohen's d = .244).

Table 1: Paired Samples T-Tests of Pre- and Post-Survey Dimensions of Integrative Learning

Dimension of Integrative Learning	Pre-Survey Mean (Standard Deviation)	Post-Survey Mean (Standard Deviation)	Mean Difference	Effect size (Cohen's d)
Dimension 1: Identify knowledge, skills, and values	4.257 (0.472)	4.436 (0.459)	0.179***	0.375
Dimension 2: Provide evidence of knowledge, skills, and values to others	3.911 (0.655)	4.261 (0.572)	0.349***	0.539
Dimension 3: Recognize and adapt to differences in order to create solutions	4.427 (0.431)	4.536 (0.444)	0.109***	0.244
Dimension 4: Work with others to identify and address complex problems	4.243 (0.482)	4.401 (0.476)	0.158***	0.309
Dimension 5: Develop a professional digital identity	3.563 (0.916)	4.029 (0.845)	0.466***	0.468

***p< 001

Focusing on the pre-survey mean values, it is striking how high the pre-survey means are; the scale for each dimension spans from 1 to 5 and three of the five dimensions have pre-survey means greater than 4. With pre-survey means greater than 4 and the highest scale value capped at 5, there is not much room to increase. Despite this potential limitation, there were significant positive changes for all five dimensions of integrative learning. At the same time, while a potential ceiling effect did not contribute to a lack of statistical significance, it may have tempered the effect sizes of the dimensions that had high mean pre-survey values.

Next, I present the results of the causal research design. While previously the results demonstrated that students experience significant positive changes in all five dimensions of integrative learning, it is impossible to determine from those results that the change can be attributed to the MPortfolio process or that the change is a result of a variety of other factors in students' lives. The delayed treatment control group design eliminates selection bias by

comparing a treatment group of students who experience the MPortfolio process to a control group of students who have not yet participated in the process.

Comparing the two groups on observable characteristics, they appear to be the same. Regarding academic ability, the mean composite ACT scores for the treatment (M = 29.5) and control (M=29.4) groups were not significantly different (p=.902). Since this comparison was made during the first semester of the first year, it is not possible to make comparisons based on grade point average. Regarding demographics, the groups were similarly composed, which chi-square tests revealing no significant differences by sex or race. Females comprised 72.9% of the treatment group and 63.6% of the control group (p=.540). Due to the small size of the control group, I aggregated students of color into a single group, which comprised 26.7% of the treatment group and 18.2% of the control group (p=.560). There were no international students in the control group and international students accounted for only 4.3% of the treatment group.

The next comparison of the treatment and control groups is concerning the dimensions of integrative learning at the time of the pre-survey for the treatment group and the baseline survey, prior to enrolling in the course, for the control group. Table 2 presents the means for each dimension for the treatment and control groups and the difference between the group means. For four of the five dimensions of integrative learning, there were no significant differences between the treatment and control groups at Time 1 of the causal design. The one exception was Dimension 1: Identify knowledge, skills, and values. For this dimension, students in the control group had a significantly higher baseline mean than the treatment group.

Table 2: Dimensions of Integrative Learning at Baseline, Treatment and Control Groups

Dimension of Integrative Learning	Treatment Mean (Standard Deviation)	Control Mean (Standard Deviation)	Mean Difference
Dimension 1: Identify knowledge, skills, and values	3.961 (0.516)	4.377 (0.340)	-0.415*
Dimension 2: Provide evidence of knowledge, skills, and values to others	3.681 (0.611)	3.835 (0.400)	-0.154
Dimension 3: Recognize and adapt to differences in order to create solutions	4.266 (0.490)	4.352 (0.487)	-0.087
Dimension 4: Work with others to identify and address complex problems	4.098 (0.467)	4.104 (0.561)	-0.006
Dimension 5: Develop a professional digital identity	3.438 (0.884)	3.455 (0.910)	-0.017

* Significant at .05 level

Table 3 shows that, for Dimension 1: Identify knowledge, skills, and values, there was a significant main effect for the change from Time 1 to Time 2, $F(1, 57) = 5.268$, $p<.05$, $\eta 2=.085$. This result demonstrates that the total sample of both the treatment group and the control group experienced a significant positive change. The within-subjects interaction of time and treatment is the key component of the analysis, as it determines whether the treatment and control groups experience significantly different changes from Time 1 to Time 2. In other words, based on this

Table 3: Repeated Measures ANOVA to Demonstate the Effect of MPortfolio on Integrative Learning, Dimension 1: Identify knowledge, skills, and values

	df	MS	F	p		η^2
Within-Subjects						
Time	1	0.629	5.268	0.025	*	0.085
Time*Treatment	1	4.008	33.554	<0.001	***	0.371
Error (MPortfolio)	57	0.119				
Between-Subjects						
Treatment	1	0.060	0.194	0.662		0.003
Error	57	0.310				

* Significant at .05 level

*** Significant at .001 level

research design, this interaction reveals whether there is a causal relationship between engagement in the MPortfolio process and integrative learning. The significance of the interaction, $F(1, 57) = 33.554$, $p<.001$, $\eta 2=.371$, provides evidence that MPortfolio effects students' abilities to identify their knowledge, skills, and values.

Figure 5 illustrates how the treatment group and the control group change from Time 1 to Time 2. As noted above, compared to the treatment group, the control group had a significantly higher mean value for this dimension at Time 1. A paired-samples t-test of the treatment group revealed a significant positive change from the pre-survey to the post-survey ($p<.001$). At the

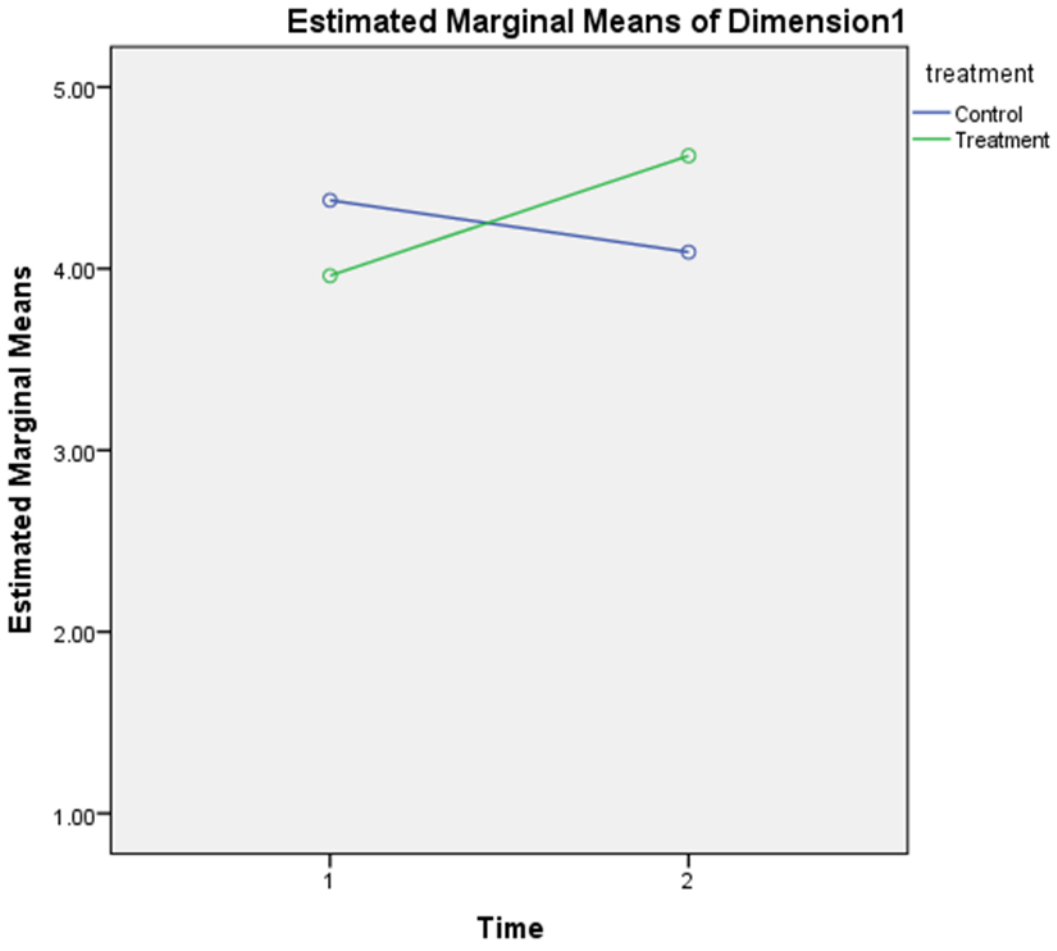

Figure 5: Effect of MPortfolio on Dimension 1: Identify knowledge, skills, and values

same time, students in the control group demonstrated a significant decline ($p<.05$) from Time 1, when they took the baseline survey prior to their enrollment in the course, and Time 2, when they took the pre-survey.

The results of the causal model for Dimension 2: Provide evidence of knowledge, skills, and values to others are featured in Table 4. Again, there is a significant main effect that demonstrates that the total sample of both treatment and control groups experienced a significant positive change from Time 1 to Time 2, $F(1, 57) = 13.876$, $p<.001$, $\eta 2=.196$. Most importantly, the interaction between time and treatment provides evidence that there is a causal relationship between engagement in MPortfolio and the development of students' abilities to provide evidence of their knowledge, skills, and values to others, $F(1, 57) = 21.375$, $p<.001$, $\eta 2=.273$. There was also a significant between-subjects difference, according to the model. This between-subjects test tells us that the treatment and control groups have significantly different mean values for Dimension 2, when averaged across both time points. The between-subjects differences revealed in this and the other repeated measures ANOVA models are not useful for answering this study's research questions since the research questions are concerned with change from Time 1 to Time 2 rather than average differences over time.

Table 4: Repeated Measures ANOVA to Demonstrate the Effect of MPortfolio on Integrative Learning, Dimension 2: Provide evidence of knowledge, skills, and values to others

	df	MS	F	p		η^2
Within-Subjects						
Time	1	2.621	13.876	<0.001	***	0.196
Time*Treatment	1	4.038	21.375	<0.001	***	0.273
Error (MPortfolio)	57	0.189				
Between-Subjects						
Treatment	1	1.842	4.948	0.03	*	0.08
Error	57	0.372				

* Significant at .05 level

*** Significant at .001 level

Figure 6 visualizes the effect of MPortfolio on students' abilities to provide evidence of their knowledge, skills, and values to others. At Time 1, there was no significant difference between the treatment and control groups ($Mean_{treatment}$=3.68, $Mean_{control}$=3.83, p=.429). Using a paired-samples t-test to compare the means of Time 1 and Time 2, there was no significant difference for the control group (p=.364). For the treatment group, there was a significant positive change from Time 1 to Time 2 (p<.001).

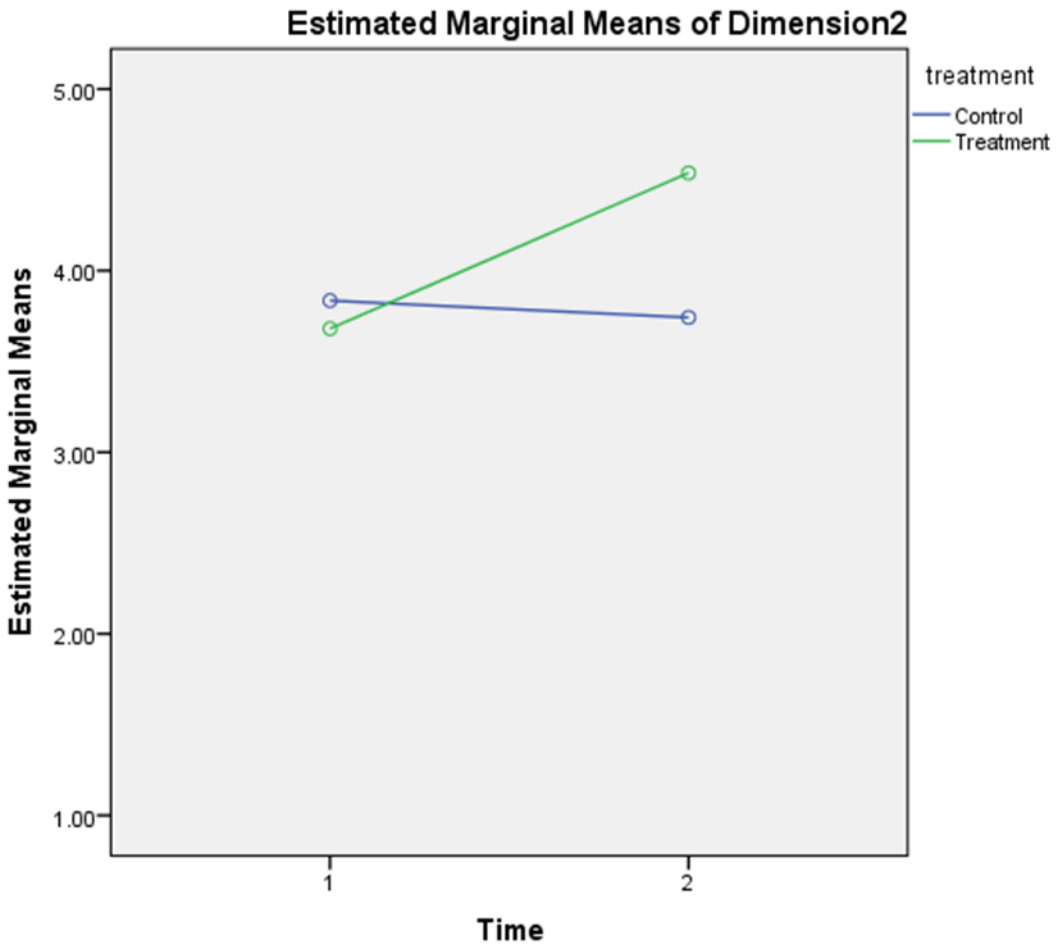

Figure 6: Effect of MPortfolio on Dimension 2: Provide evidence of knowledge, skills, and values to others

For Dimension 3: Recognize and adapt to differences in order to create solutions, there was also a significant positive effect associated with engagement in the MPortfolio process, F (1, 57) = 12.63, p<.001, η2=.181. See Table 5 for the complete model results. Figure 7 provides a visual of the changes that the treatment and control groups for Dimension 3. On average, this is the dimension in which students reported having the strongest ability at Time 1. Comparing the two groups, there was no significant difference at Time 1 between the treatment and control groups ($Mean_{t1}$=4.27, $Mean_{c1}$=4.35, p=.598). The treatment group experienced a significant positive change from Time 1 to Time 2 ($Mean_{t1}$=4.27, $Mean_{t2}$=4.62, p<.001), while there was slight, non-significant decline between Time 1 and Time 2 for the control group ($Mean_{t1}$=4.35, $Mean_{t2}$=4.18, p=.192).

Table 5: Repeated Measures ANOVA to Demonstrate the Effect of MPortfolio on Integrative Learning, Dimension 3: Recognize and adapt to differences in order to create solutions

	df	MS	F	p		η^2
Within-Subjects						
Time	1	0.155	1.577	0.214		0.027
Time*Treatment	1	1.244	12.63	0.001	**	0.181
Error (MPortfolio)	57	0.098				
Between-Subjects						
Treatment	1	0.561	1.952	0.168		0.033
Error	57	0.287				

** Significant at .01 level

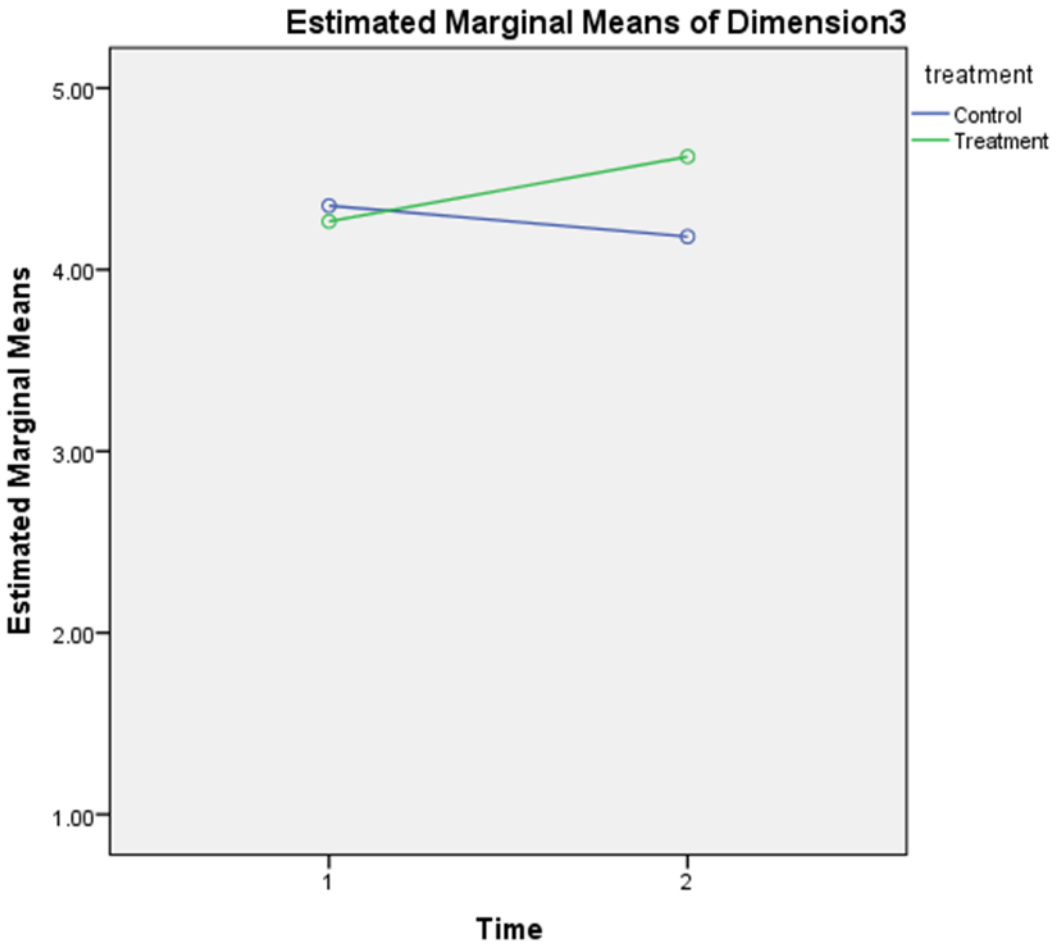

Figure 7: Effect of MPortfolio on Dimension 3: Recognize and adapt to differences in order to create solutions

There was also a significant positive effect for the fourth dimension of integrative learning, work with others to identify and address complex problems. Reported in detail in Table 6, in addition to there being a significant positive main effect for time, $F(1, 57) = 4.946$, $p<.05$, $\eta 2=.080$, the interaction between time and the treatment reveals that there is a causal relationship between engagement in MPortfolio and students' abilities to work with others to identify and address complex problems, $F(1, 57) = 9.382$, $p<.01$, $\eta 2=.141$. At Time 1, the mean Dimension 4 value was 4.10 for both the treatment group and the control group ($p=.972$). From

Time 1 to Time 2, the mean for the control group declined slightly and non-significantly to 4.026 (p=.671), while the mean for the treatment group increased significantly to 4.589 (p<.001).

Table 6: Repeated Measures ANOVA to Demonstrate the Effect of MPortfolio on Integrative Learning, Dimension 4: Work with others to identify and address complex problems

	df	MS	F	p		η^2
Within-Subjects						
Time	1	0.764	4.946	0.030	*	0.080
Time*Treatment	1	1.449	9.382	0.003	**	0.141
Error (MPortfolio)	57	0.154				
Between-Subjects						
Treatment	1	1.391	4.659	0.035	*	0.076
Error	57	0.299				

* Significant at .05 level

** Significant at .01 level

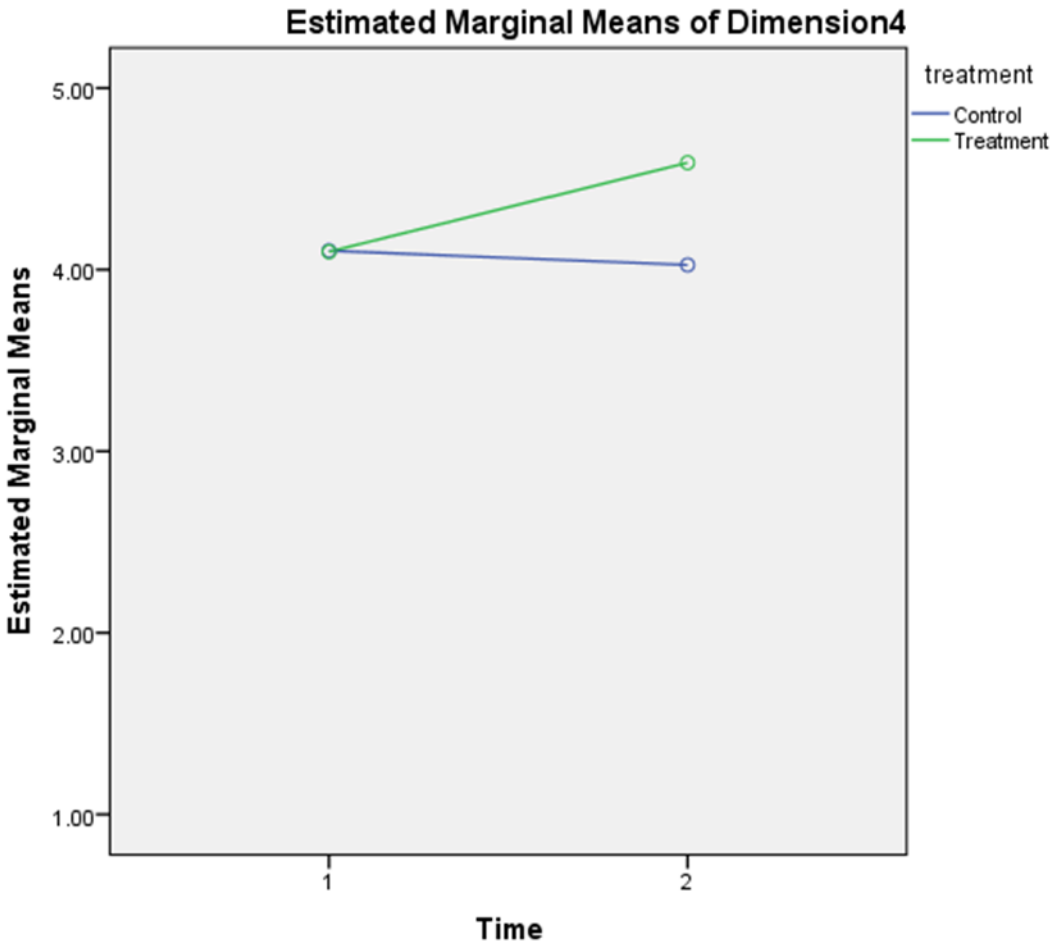

Figure 8: Effect of MPortfolio on Dimension 4: Work with others to identify and address complex problems

The results for Dimension 5: Develop a professional digital identity were a bit different from the results for the other four dimensions. Table 7 shows that there was a significant main effect for time, $F(1, 57) = 11.55$, $p<.01$, $\eta 2=.168$, meaning that the combined treatment and control groups experienced a significant positive change from Time 1 to Time 2. The interaction between time and treatment, indicating whether there is a causal relationship, was only marginally significant, $F(1, 57) = 3.594$, $p<.10$, $\eta 2=.059$. At Time 1, the mean Dimension 5 values for the treatment and control groups were not only not significantly difficult but they were also nearly identical ($Mean_{t1}=3.438$, $Mean_{c1}=3.456$, $p=.954$). From Time 1 to Time 2, each group saw a positive change, as depicted in Figure 9. The change for the treatment group was significant ($Mean_{t1}=3.438$, $Mean_{t2}=4.292$, $p<.001$), while the increase for the control group was not significant ($Mean_{c1}=3.455$, $Mean_{c2}=3.697$, $p<.233$).

Table 7: Repeated Measures ANOVA to Demonstrate the Effect of MPortfolio on Integrative Learning, Dimension 5: Develop a professional digital identity

	df	MS	F	p		η^2
Within-Subjects						
Time	1	5.381	11.55	0.001	**	0.168
Time*Treatment	1	1.675	3.594	0.063	~	0.059
Error (MPortfolio)	57	0.466				
Between-Subjects						
Treatment	1	1.493	1.995	0.163		0.034
Error	57	0.749				

~ Significant at .10 level
* Significant at .05 level
** Significant at .01 level
*** Significant at .001 level

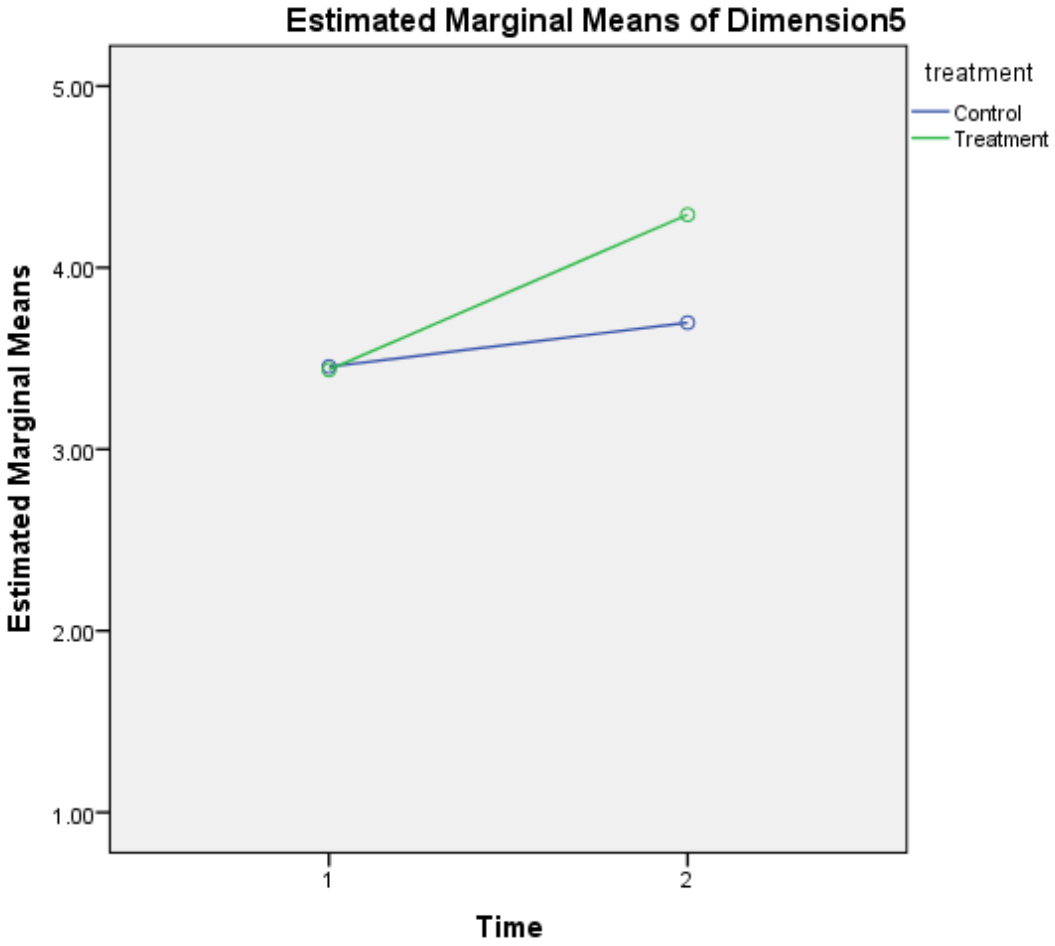

Figure 9: Effect of MPortfolio on Dimension 5: Develop a professional digital identity

Finally, I answer the research sub-question, "Does the development that students experience persist beyond their initial experiences using ePortfolios?" Having established that students experience significant positive changes across all five dimensions of integrative learning, this question aims to determine whether students' learning gains are lasting. These results are based on the responses of students who responded to the pre-survey, the post-survey, and a follow-up survey two years after their MPortfolio experience. Unlike previous results, the time effect explored in this design is a three-level effect (i.e., pre-survey, post-survey, follow-up survey) demonstrating how integrative learning changes over two time periods. The first time period occurred during the MPortfolio process and the second occurred from the time the MPortfolio process ends to approximately two years later at the time of the follow-up survey.

Table 8 presents the mean values for each dimension of integrative learning at the pre-survey, post-survey, and follow-up survey for the analytic sample used to answer this research sub-question. Again, the main statistical approach is a repeated-measures ANOVA. For a three-level design, a significant main effect indicates only that a significant different exists from one level to another, but the procedure does not reveal whether the difference is between $time_1$ and $time_2$ or between $time_2$ and $time_3$. After establishing whether the main effect is significant, I then use paired-samples t-tests to identify the differences. Another difference related to a three-level repeated-measures ANOVA is that the assumption of sphericity applies, since there are now multiple combinations of levels and the variances of these differences must be roughly equal. Unless indicated otherwise, the statistical models do not violate the assumption of sphericity.

Table 8: Mean Dimensions of Integrative Learning, Pre-Survey to Post-Survey to Follow-Up Survey			
	Pre-Survey Mean (Std Dev)	Post-Survey Mean (Std Dev)	Follow-Up Survey Mean (Std Dev)
Dimension 1: Identify knowledge, skills, and values	4.194 (0.456)	4.429 (0.411)	4.421 (0.405)
Dimension 2: Provide evidence of knowledge, skills, and values to others	3.796 (0.762)	4.308 (0.519)	4.110 (0.592)
Dimension 3: Recognize and adapt to differences in order to create solutions	4.368 (0.426)	4.544 (0.456)	4.528 (0.424)
Dimension 4: Work with others to identify and address complex problems	4.201 (0.471)	4.419 (0.440)	4.368 (0.469)
Dimension 5: Develop a professional digital identity	3.350 (0.940)	3.960 (0.856)	3.209 (1.171)

For Dimension 1: Identify knowledge, skills, and values, there was a significant main effect for time, $F(2, 116) = 12.219$, $p < .001$, $\eta 2 = .174$. Reviewing the plot that illustrates the changes in value from pre-survey to post-survey to follow-up survey (Figure 10), it appears that students markedly increased their mean values for Dimension 1 from the pre-survey to the post-survey and the change from the post-survey to the follow-up survey two years later was minimal. The paired-samples t-test confirms this. There was a significant positive increase in the mean value over the course of the MPortfolio process ($Mean_{t1} = 4.194$, $Mean_{t2} = 4.429$, $p < .001$). While there was a very slight decline from the post-survey to the follow-up survey, these means were not significantly different ($Mean_{t2} = 4.429$, $Mean_{t3} = 4.421$, $p = .890$). Further, students' self-reported ability to identify their knowledge, skills, and values was significantly higher at the time of the follow-up survey compared to the start of the MPortfolio process ($Mean_{t1} = 4.194$, $Mean_{t3} = 4.421$, $p < .001$).

Table 9: Three-Level Repeated Measures ANOVA for Integrative Learning, Dimension 1: Identify knowledge, skills, and values

	df	MS	F	p		η^2
Within-Subjects						
Time	2	1.052	12.219	<.001	***	0.174
Error(Time)	116	0.860				

*** Significant at .001 level

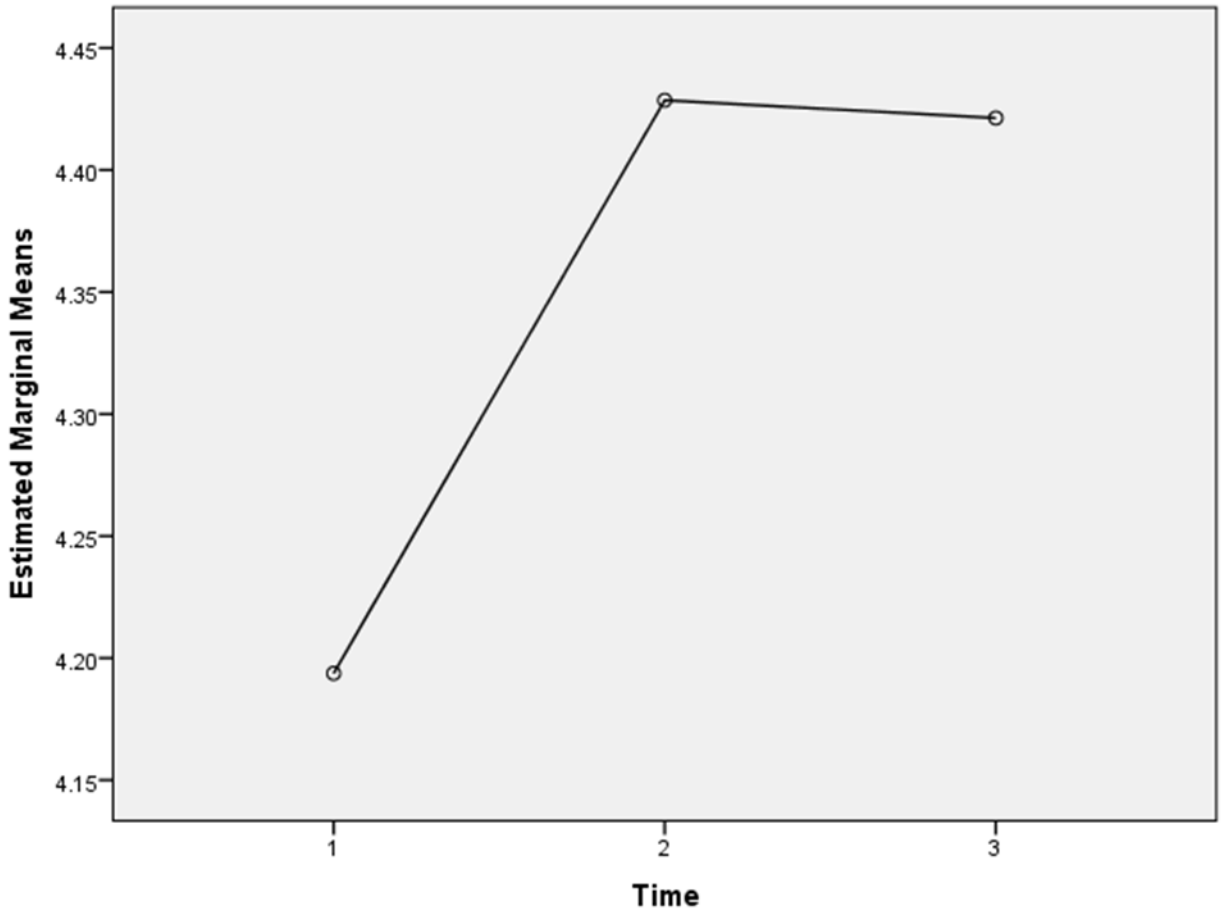

Figure 10: Change of Integrative Learning Dimension 1: Identify knowledge, skills, and values, from Pre-Survey to Post-Survey to Follow-Up Survey

There was a different pattern exhibited for Dimension 2: Provide evidence of knowledge, skills, and values to others. For the repeated measures ANOVA, Mauchly's Test of Sphericity was significant (W=.884, χ^2=7.035, p=.030) indicated the sphericity assumption was violated, so the Greenhouse-Geisser estimates were interpreted to correct for this violation. The model indicated that there was a significant time effect, F (1.792, 116) =16.492, p<.001, η2=.221, and the plot in Figure 11 demonstrates an increase in the mean Dimension 2 value from the pre-survey to the post-survey and a decrease from the post-survey to the follow-up survey. The paired samples t-tests show that students' reported a significantly stronger ability to provide evidence of knowledge, skills, and values at the end of the MPortfolio process compared to the start ($Mean_{t1}$=3.796, $Mean_{t2}$=4.308, p<.001). The decrease in the mean value from the post-survey to the follow-up survey was also significant ($Mean_{t2}$=4.308, $Mean_{t3}$=4.110, p=.011). Although this was a significant decline, the mean on the follow-up survey was still significantly higher than the pre-survey mean value ($Mean_{t1}$=3.796, $Mean_{t3}$=4.110, p=.001). These results indicate that the learning gains related to the ability to provide evidence of knowledge, skills, and values begin to fade in the two years after the MPortfolio experience; however, two years later this ability is still significantly stronger than it was at the start of the process.

Table 10: Three-Level Repeated Measures ANOVA for Integrative Learning, Dimension 2: Provide evidence of knowledge, skills, and values to others

	df	MS	F	p		η^2
Within-Subjects						
Time	1.792	4.391	16.492	<.001	***	0.221
Error(Time)	116	0.239				

*** Significant at .001 level

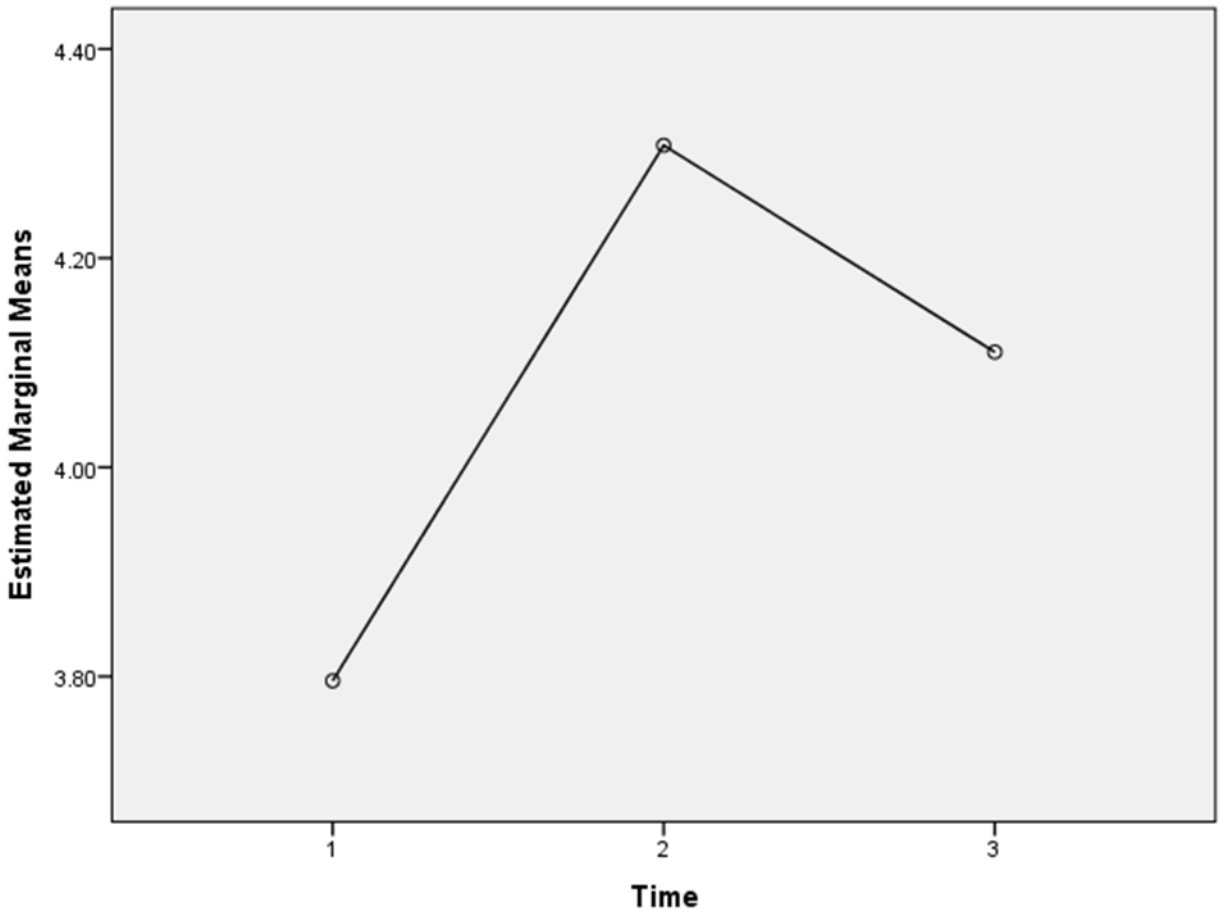

Figure 11: Change of Integrative Learning Dimension 2: Provide evidence of knowledge, skills, and values to others, from Pre-Survey to Post-Survey to Follow-Up Survey

The pattern for Dimension 3: Recognize and adapt to differences in order to create solutions resembled that of Dimension 1; there was a notable increase from the pre-survey mean to the post-survey mean and there was a slight decrease from the post-survey to the follow-up survey (see Figure 12). The model described in Table 11 indicates that there is a main time effect, $F(2, 116) = 6.718$, $p = .002$, $\eta 2 = .104$, meaning that students' self-reported abilities to recognize and adapt to differences in order to create solutions change over time. The paired samples t-tests reveal that the mean value from the post-survey is significantly higher than the mean value on the pre-survey ($Mean_{t1} = 4.368$, $Mean_{t2} = 4.544$, $p = .002$) and there was no

significant difference between the post-survey and the follow-up survey values ($Mean_{t2}$=4.544, $Mean_{t3}$=4.528, p=.742). Comparing the pre-survey to the follow-up survey, students' self-reported abilities to recognize and adapt to differences were significantly stronger, on average, on the latter survey ($Mean_{t1}$=4.368, $Mean_{t3}$=4.528, p=.004).

Table 11: Three-Level Repeated Measures ANOVA for Integrative Learning, Dimension 3: Recognize and adapt to differences in order to create solutions

	df	MS	F	p		η^2
Within-Subjects						
Time	2	0.560	6.718	0.002	**	0.104
Error(Time)	116	0.083				

** Significant at .01 level

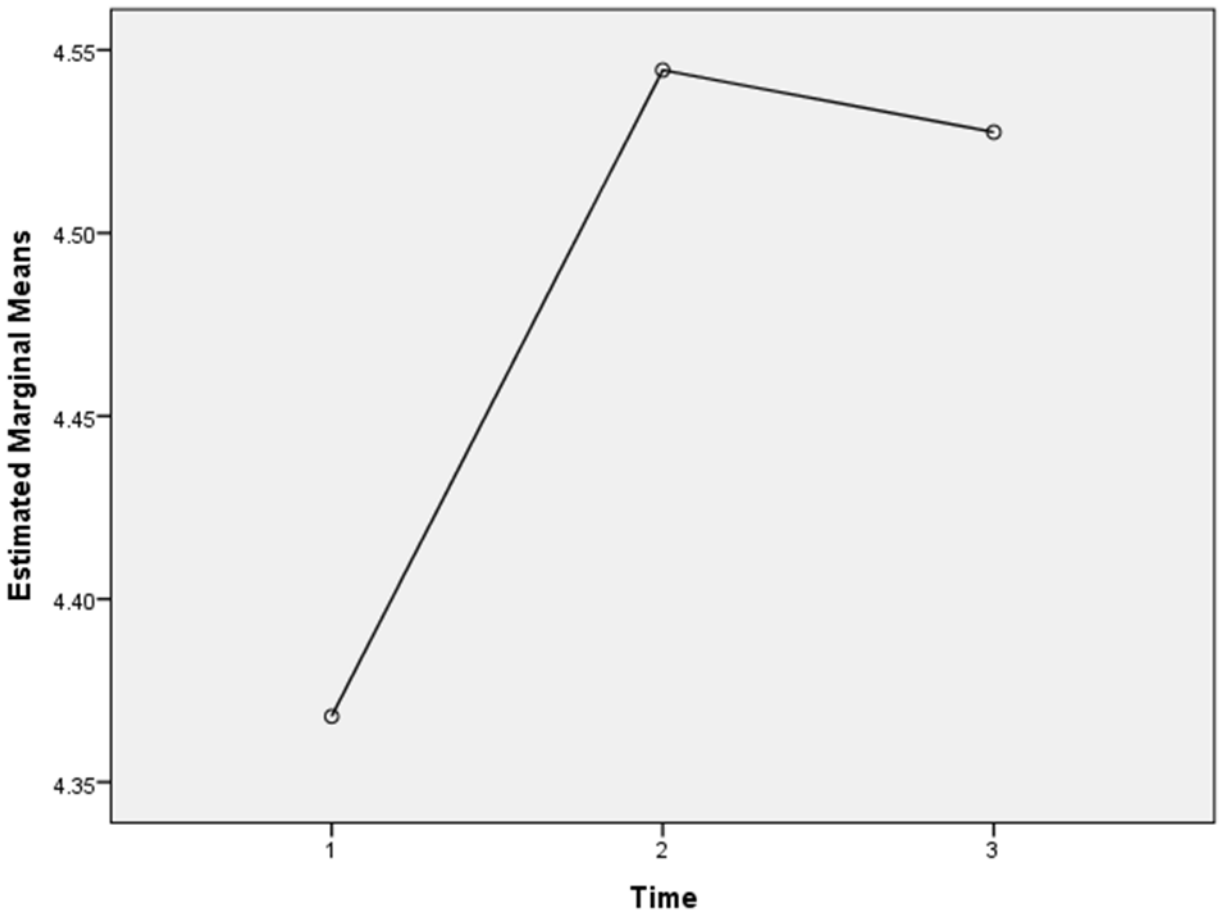

Figure 12: Change of Integrative Learning Dimension 3: Recognize and adapt to differences in order to create solutions, from Pre-Survey to Post-Survey to Follow-Up Survey

Reported in Table 12, there was also a significant main effect for Dimension 4: Work with others to identify and address complex problems, F (2, 112) = 6.718, p=.001, η2=.115. For this dimension, there was a significant increase from the pre-survey mean value to the post-survey ($Mean_{t1}$=4.201, $Mean_{t2}$=4.419, p=.001). Again, while there was a slight decrease from the post-survey to the follow-up survey, these means were not significantly different ($Mean_{t2}$=4.419, $Mean_{t3}$=4.368, p=.367). Finally, comparing the pre-survey and follow-up survey results, students reported significantly stronger abilities to work with others to identify and address complex problems two years after going through the MPortfolio process ($Mean_{t1}$=4.201, $Mean_{t3}$=4.368, p=.014). Figure 13 represents the change that students experience for Dimension 4: Work with others to identify and address complex problems.

Table 12: Three-Level Repeated Measures ANOVA for Integrative Learning, Dimension 4: Work with others to identify and address complex problems

	df	MS	F	p		η^2
Within-Subjects						
Time	2	0.560	6.718	0.001	**	0.115
Error(Time)	112	0.114				

** Significant at .01 level

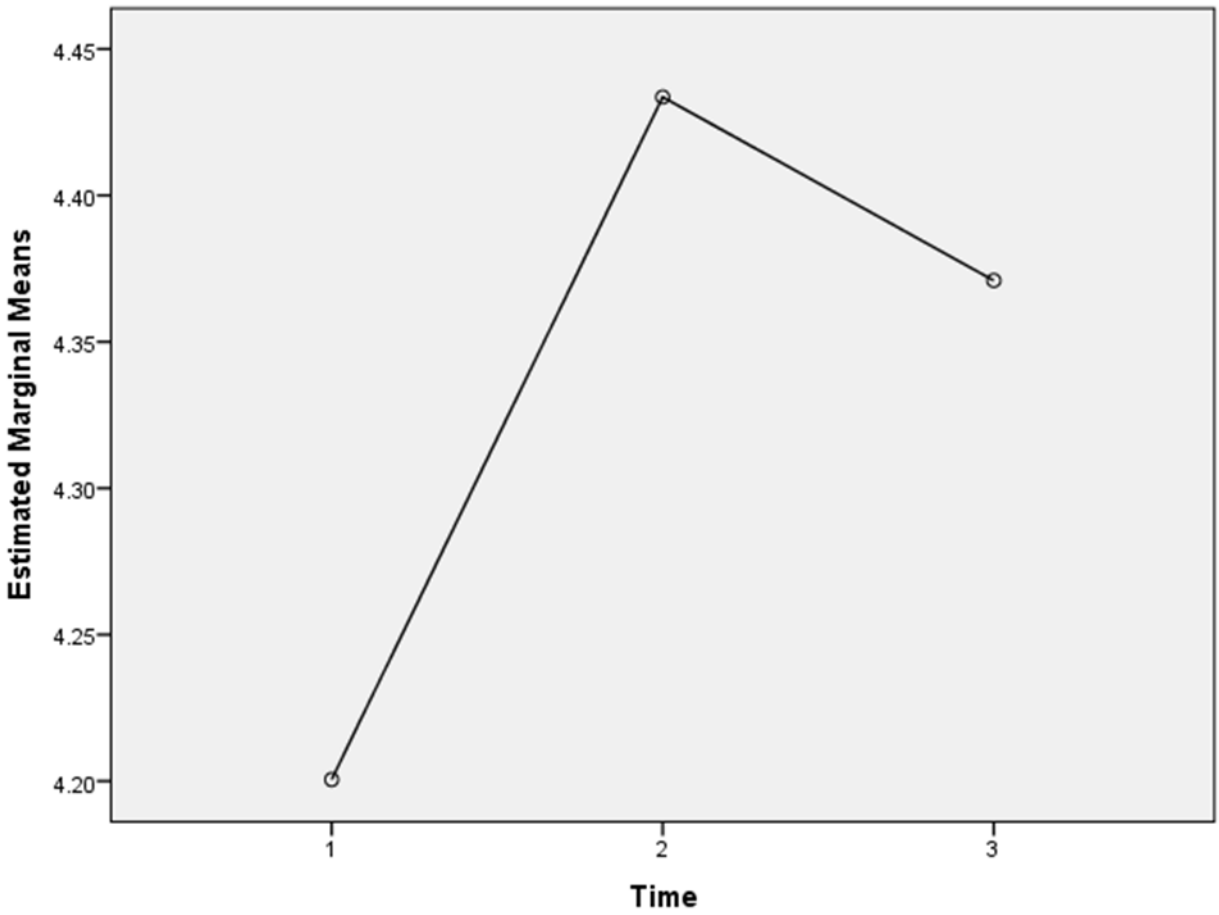

Figure 13: Change of Integrative Learning Dimension 4: Work with others to identify and address complex problems

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Table 13 shows that, for Dimension 5: Develop a professional digital identity, there was a significant main effect, F (2, 116) = 13.396, p<.001, η2=.118. However, Figure 14 demonstrates that the change that students experience is different from what they undergo with other dimensions of integrative learning. Like the other dimensions, the post-survey mean was significantly higher than the pre-survey mean ($Mean_{t1}$=3.350, $Mean_{t2}$=3.960, p<.001). From the post-survey to the follow-up survey, there was a significant decrease ($Mean_{t2}$=3.960, $Mean_{t3}$=3.209, p<.001) in the mean for develop a professional digital identity. Two years after the MPortfolio process, students reported that, on average, their ability to develop a professional

digital identity was no different from when they started MPortfolio ($Mean_{t1}$=3.350, $Mean_{t3}$=3.209, p=.389). This means that students' learning gains related to developing a professional digital identity evaporated within two years.

Table 13: Three-Level Repeated Measures ANOVA for Integrative Learning, Dimension 5: Develop a professional digital identity

	df	MS	F	p		η^2
Within-Subjects						
Time	2	9.409	13.396	<.001	***	0.118
Error(Time)	116	0.702				

*** Significant at .001 level

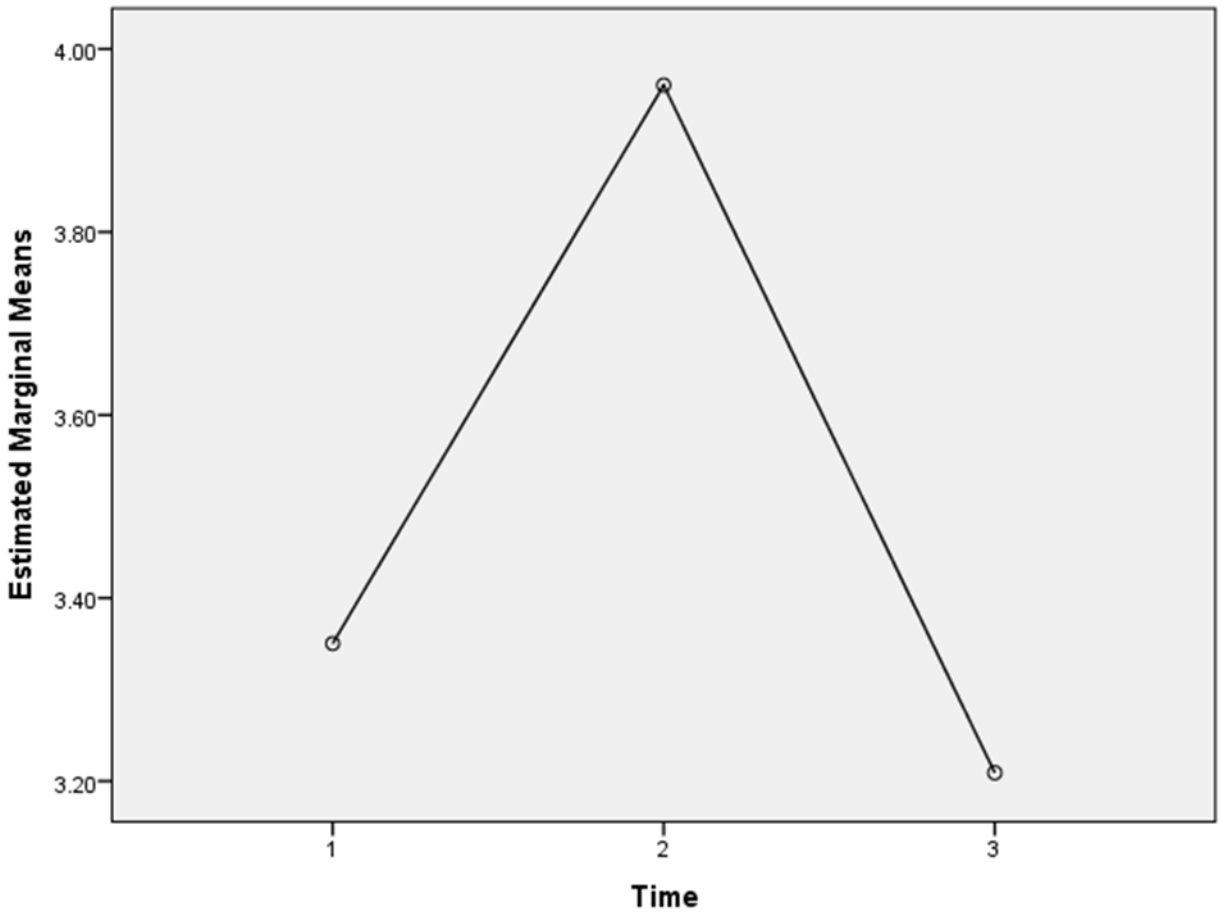

Figure 14: Change of Integrative Learning Dimension 5: Develop a professional digital identity

Discussion

This research makes a contribution not only to our understanding of how we can structure programs to enhance student achievement but also by building theory that explains how students learn. Regarding the potential applied contribution, this research aimed to explore the impact of an educational process designed to help students identify their knowledge, skills, and values so that they can connect and apply what they have learned to new situations, both as students and beyond. Overall, these results provide very encouraging evidence in support of an intervention that helps students foster integrative learning. Students who engage in the MPortfolio process, on average, experience significant learning gains across all five dimensions of integrative learning. Each dimension had a small to moderate effect size. Notably, the largest effect size related to students' abilities to provide evidence of their knowledge, skills, and values to others. Additionally, for four of these five dimensions, students, on average, maintained these significant gains two years after their MPortfolio experience. Not only do students learn through this process, the learning stays with them over time.

The main limitation of this type of pre/post research design is that one cannot make causal claims about the impact of the program. In other words, it is plausible that the changes that students experience are no different from the changes that they would have experienced anyway, if they had not gone through this process. The delayed treatment, control group design employed in this study addresses this limitation by eliminating selection bias in order to determine causality. The results of this research provide evidence of significant, positive effects with fairly large effect sizes for all five dimensions of integrative learning. The vast majority of research on the relationship between assessment and student achievement uses designs that allow researchers to establish correlations but not to make causal claims about this relationship. The

use of this research design coupled with the significant findings in support of the program suggest that this study could have a demonstrable impact on our understanding of both theory and practice related to both assessment and student learning.

Regarding the potential theoretical contribution, the outcome of the research, integrative learning, has been recognized as an essential learning goal for 21st century higher education. Given its importance as a student outcome, there has been relatively little empirical research and theory building on integrative learning. This research expands the AAC&U's existing definition of integrative learning by incorporating a relational aspect that recognizes that individuals' learning experiences are inextricable from their social identities and interactions with others. The Integrative Learning Self-Assessment, the instrument employed in this research, reflects this relational aspect of integrative learning and asks students to reflect on the ways they integrate their learning in a far more detailed ways than the instruments employed in other studies that explore integrative learning. Additionally, the study breaks new ground by establishing a causal link between this construct of integrative learning and the reflective ePortfolio process. There is a great need for research that deeply explores how students learn by reflecting upon and integrating their disparate learning experiences and this study is a positive step as we develop our understanding of this topic.

In thinking about future directions for this research, it is important to acknowledge some of the limitations of the current study. One issue with the study is its reliance on self-reported levels of achievement of student outcomes. Historically, self-reported gains have been used extensively in research in postsecondary education. However, recent research calls into question the validity of self-reported measures. Porter (2011) analyzed the literature on this topic and concluded that students' self-reported measurements of their own experiences and the outcomes

of their college experience fail to meet basic standards for validity and reliability. Other studies have reported mixed support for the validity of student self-reported measures. Anaya (1999) found that student-reported cognitive growth had modest relative validity, while studies conducted by Bowman (2010) and Gosen and Washbush (1999) indicate that self-reported gains had low correlations with direct measures of longitudinal change. While this is a potential limitation of the existing research, self-reported measures have been made essential contributions not only to higher education research but also to a much broader sphere of social science research. Pascarella (2001) and Pike (1995) urge institutions and researchers to exercise caution when using self-reported data and caution seems to be the most appropriate approach for carrying out the present study.

Similarly, the use of self-reported data introduces the issue of ceiling effects. The mean pre-survey values are particularly high for multiple dimensions of integrative learning. For example, the mean pre-survey value for Dimension 3: Recognize and adapt to differences in order to create solutions is 4.427, on a five-point scale. This is problematic for two reasons. First, from a statistical perspective, there is a cutoff in the distribution at the upper limit. This can lead to violations of the normality assumption and reported values at the upper limit may not be valid representations of the construct being measured. Second, for practical reasons, having such high pre-survey mean values when measuring student change leaves very little room for student improvement. It is encouraging that, despite the high pre-survey values, there were significant gains.

In order to address the issues of self-reported data and ceiling effects, a future direction for this research should be the analysis of ePortfolio content. As a tool for making learning visible, the ePortfolios include a wealth of information about student experiences, their

reflections on these experiences, and their learning through the process. Analyzing this content can both validate self-reported responses and provide a much richer interpretation of students' experiences with and learning as a result of the MPortfolio process.

Finally, there is another future direction for this research that I have pursued but falls outside the already vast scope of the current study. This direction is to explore the differences between students who go through the MPortfolio process to identify sources of variation in student development. Ideally, this process will affect students equally, regardless of demographic characteristics, academic abilities, and co-curricular experiences. However, this may not be the case and it is important to determine what differences may exist. Additionally, to evaluate the strengths of the process, it is helpful to determine what learning process characteristics are associated with the largest gains. For example, do students in small groups fare better than those in large groups? Does the method of facilitation result in variation in integrative learning gains? Does it matter whether students engage in this process during the fall term or the winter term? Answering all of these questions can provide insight into how best to engage students in this reflective learning process.

Conclusion

The goal of this research is to increase our understanding about how students integrate their learning and whether educators can facilitate this process through the use of reflective ePortfolios. As this is the intersection of two emerging topics (integrative learning and ePortfolios), there is an opportunity to contribute to theory and practice in both of these areas. This research has implications for educators developing academic and co-curricular programs with integrative learning as an intended learning outcome. The present study provides evidence that the use of reflective ePortfolios results in significant learning gains for each dimension of

integrative learning. Additionally, these learning gains persist years beyond the initial reflective ePortfolio experience. By recognizing that it is possible to facilitate integrative learning and understanding the ways in which we can best manage this process, educators can construct interventions that will enable students to make meaningful connections of their experiences, synthesize their learning, and gain a greater understanding of how their skills and knowledge can help them achieve their academic, professional, and personal goals.

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