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INTEGRATING INSTITUTIONAL AND INSTRUCTIONAL UNIT-LEVEL OUTCOMES: AN EVALUATION OF AN INSTRUCTIONAL STRATEGY FOR THE DEVELOPMENT OF DUAL OUTCOMES

by

Kory Wendel Godfrey

A dissertation

submitted in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy in Instructional Design

Department of Organizational Learning and Performance

Idaho State University

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Committee Approval

To the Graduate Faculty:

The members of the committee appointed to examine the dissertation of KORY GODFREY find it satisfactory and recommend that it be accepted.

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September 28, 2015

Kory Godfrey
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RE: regarding study number IRB-FY2016-44: INTEGRATING INSTITUTIONAL AND INSTRUCTIONAL UNIT-LEVEL OUTCOMES: AN EVALUATION OF AN INSTRUCTIONAL STRATEGY FOR THE DEVELOPMENT OF DUAL OUTCOMES

Dear Mr. Godfrey:

I agree that this study qualifies as exempt from review under the following guideline: Category 1: Normal educational practices & settings. This letter is your approval, please, keep this document in a safe place.

Notify the HSC of any adverse events. Serious, unexpected adverse events must be reported in writing within 10 business days.

You are granted permission to conduct your study effective immediately. The study is not subject to renewal.

Please note that any changes to the study as approved must be promptly reported and approved. Some changes may be approved by expedited review; others require full board review. Contact Tom Bailey (208-282-2179; fax 208-282-4723; email: humsubj@isu.edu) if you have any questions or require further information.

Sincerely,

Ralph Baergen, PhD, MPH, CIP
Human Subjects Chair

BYU
IDAHO

September 29, 2015

Dear Kory,

Your request to use human subjects for the study entitled *Integrating Institutional and Instructional Unit-Level Outcomes: An Evaluation of an Instructional Strategy for the Development of Dual Outcomes* is approved for 12 months from the date of this letter.

Please notify the IRB if you intend to make any significant modifications to the study's design or implementation.

Good luck with your study.

Regards,

Scott J. Bergstrom, Ph.D.
Chair, BYU-Idaho Institutional Review Board

Scott J. Bergstrom *Director, Institutional Research & Assessment, Kimball 290C*
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I could not and would not have made it this far in my own educational journey without the commitment and determination of my dear wife Annie. Her sacrifices to

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I dedicate this work to my children—Kimball, Jillian, Miles, Estelle, and Claire. It is my earnest hope that they will also develop the desire and the capacities to become active and consistent lifelong learners both for their own benefit and to pass the legacy on to their children.

Finally, I acknowledge the influence of God's involvement and help in my life personally and in the establishment of this nation. In an age when many often forget or want to ignore what it took to establish this country as a haven of freedom, I am grateful for men and women who were willing to set aside personal interests and accolades to create a climate of national autonomy under the guidance of a Supreme Being. The birth and growth of this nation seem to show the pattern and keys for improved growth and development at the personal level as well.

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ABSTRACT

While the rhetoric and enthusiasm surrounding the lifelong learning movement is growing, many of the methods of implementation and the ramifications of those methods have not been closely examined. For example, what specifically happens to student outcomes that are sometimes seen as conflicting when existing instruction targeting student achievement are merged with instruction targeting specific lifelong learning skills? Using a Solomon Four Group Design, this study sets out to quantitatively examine the effects on both learner autonomy (specifically the *Resourcefulness* of the learner) and computer programming performance when a course originally designed for a more traditional approach to the development of computer programming performance is redesigned to address lifelong learning skills concurrently. The results were mixed showing a small but significant effect on Resourcefulness primarily due to pretest sensitization. Results on student achievement were non-significant as desired by the course instructors and the design of the instructional intervention. The mixed results were interpreted as consistent with cognitive load theory where the pretest alone caused a significant effect on Resourcefulness, the treatment brought about a non-significant increase in Resourcefulness, but the combination of both pretest and treatment brought about a nearly negligible increase in Resourcefulness. The relationship between learner autonomy and student achievement could not be addressed due to a lack of data. Finally, student perceptions were captured through qualitative methods and did not fully agree with study findings.

CHAPTER I

Introduction

What constitutes a quality education and how can it best be achieved? These are questions that are continuously asked, discussed, debated, researched, examined, and debated again throughout history. These questions are being asked again and growing louder and more common in our modern age. Biggs and Tang (2011) examined these questions in relation to the trends exerting pressure on higher education such as increasing participation rates and grade expectations along with diversity in content, student populations, and educational goals. The introduction to their book concludes that universities will inevitably continue to specialize in order to cope with these pressures but that "the real problem of diversity lies within universities and within classrooms" (p. 12). As one instructor put it, being a teacher in the modern setting at the center of so many demands, paradigms, expectations, and opportunities "feels like being a plate spinner in a circus".

These questions also set up what can be seen as an analogy to the process versus product point of view in business. The quality management revolution of the 1970s and 1980s showed that by becoming more mindful of and constantly improving the processes by which products were made and by monitoring the effects on outputs continuously, a decrease in defects could be accomplished at the same time that an increase in the number of characteristics and complexity of the products was possible (Kanji, 1990). In a similar vein, the lifelong learning and learning-to-learn movements in education are urging that greater personal awareness and development of learning capacities and strategies become a more integrated part of the learning process. The analogy could carry

further to a dual approach of training for performance while coaching for the awareness and improvement of learning processes as dual outcomes that could potentially be mutually reinforcing.

Lifelong learning can be seen as an acknowledgement of the desire to continue to grow, change, and improve human capacities throughout the conscious existence of a human being. However, the term as used in our current society is a reflection of multiple philosophical viewpoints on the purpose and methods of education. Longworth (2003) stated, "The lifelong learning movement is now rampaging around the whole world" (p.3). While this seems to hold true in political circles and as a topic of discussion regarding educational reform, the implementation of teaching strategies that instill lifelong learning capabilities in higher education settings remains a significant gap at the day-to-day level. While educational leaders at institutions of higher learning and international committees are embracing the lifelong learning movement through policy and change initiatives, Longworth points out that there remains an "uphill fight to grasp the attention of a clientele already punch-drunk by information and more exciting vistas" (p. 121). Instructional designers and educators face key decisions regarding how to balance established content-centric educational theories, research, and practices with contemporary theories, research, and practices that are affiliated with the lifelong learning movement (see Candy, Crebert, & O'Leary, 1994; Fryer, 1997; Knapper & Cropley, 2000; Field, 2006). How to best teach or design instruction to enhance student achievement is a topic that has long been researched in a wide variety of educational scenarios. However, even with such a rich dialogue and a myriad of advocates, studying the effects of instructional design techniques and principles on student achievement

concurrently with the companion factors of lifelong learning skills can bring about new insights as to how these educational outcomes can be pursued in conjunction with one another.

From the instructional design perspective, the desire to create instructional experiences and sequences that develop learning capacity alongside traditional knowledge and skill building is being actively promoted in European educational circles (see European Commission, 2006). Earlier, Merrill, Li, and Jones (1989) called for instructional design research to move to a second generation where the instruction would become more integrated in the types of knowledge and skills involved rather than the earlier separation approaches which isolated individual knowledge sets or skills. As the lifelong learning movement attempts to take a holistic approach, learning research discussion has revived exploration of conative (will), affective (emotion), and cognitive (reasoning) factors and their interactions (Snow, Corno, & Jackson, 1996; Kuppermintz, 2002; Kyrö, Seikkula-Leino, & Myllari, 2008; Gerdes, & Stromwall, 2008; Kovač, Meško, & Bertoncelj, 2010; Beyers, 2011; Beyers 2012; Reeve, Scherbaum, & Goldstein, 2015).

One hesitation of approaching lifelong learning in the classroom is that its breadth and scope can be intimidating when considering the already full plates of teachers pressured to push students to higher performance standards (Day, 2002). Fortunately, as the saying goes even an elephant can be eaten when taken on one bite at a time. The challenge to develop a lifelong learner can be broken down to component elements that are of smaller scope that can be handled at the course and lesson levels in instruction

much like the development of a doctor occurs in smaller component pieces over many years.

Breaking a concept into component elements can be accomplished from a top-down approach taking the larger concept and attempting to decompose or isolate the separate sub-systems. Another common approach is the bottom-up method where smaller or simpler concepts and systems can be studied separately and aggregated together to form the whole (Sure, Staab, & Studer, 2002). While this may seem obvious and simple for analysis of physical objects and systems, these methods are far more challenging when attempting to decompose the unseen such as attempting to comprehend the unseen mind of a lifelong learner and what caused them to turn out that way (Packer & Goicochea, 2000). Either approach can yield a concept hierarchy showing the relationships between ideas as primarily subsuming in nature. While the concepts overlap somewhat, one is seen as more comprehensive and complete than the other. Even though they may be defined with some attributes that don't fully relate to the other, one is seen as "higher" than or more inclusive than another. Spelling out these relationships in an explicit way is often key in helping to convey complex ideas from one person to another.

Concepts and psychological constructs closely related to lifelong learning include metacognition, curiosity, intrinsic motivation, and persistence (Dunlap & Grabinger, 2003; Dave, 1976). These characteristics and processes of learning are present in a variety of learning styles and programs such as self-directed learning, autonomous learning, learning communities, distance learning, online learning, continuing education, home schooling, situational learning, professional development, and higher education. Each of these learning styles seem to share a common goal of establishing an

organizational pattern for encouraging learning and improvement that stems from a desire within the learner (Lüftenegger, Schober, Van de Schoot, Wagner, Finsterwald, & Spiel, 2012). Some inspirational quotes seem to capture this theme such as from Plutarch "For the mind does not require filling like a bottle, but rather, like wood, it only requires kindling to create in it an impulse to think independently and an ardent desire for the truth" (1927, p. 257-259), "You cannot teach a man anything; you can only help him find it within himself" attributed to Galileo Galilei (Carnegie, 1936), or "The most important learnings in life are caught—not taught" (Bednar, 2007).

Among all the rhetoric and positive sentiment surrounding lifelong learning there remains many questions around how to best implement these lofty goals on a day-to-day basis in higher education classrooms. These questions are further amplified for courses conducted in an online format. As the quotes in the prior paragraph imply, lifelong learning characteristics, habits, and skills seem to be best developed a warm, rich, learning climate such as through one-on-one interactions or a mentoring setting. How much time and attention can or should be given to helping each learner understand and improve his or her learning patterns as compared to how much focus to give to the development of knowledge or performance is a persistent question of balance that each teacher must weigh on a consistent basis. Methods for how to support instructors in a variety of instructional modes can be quite helpful.

Purpose of Study

Claxton (2007), an advocate of lifelong learning and the "learning-to-learn" movement, has called for a metaphorical "split screen" teaching approach where teachers seek to teach not only discipline-specific knowledge and skills but also to develop

general learning skills and dispositions as simultaneous learning outcomes. However, this raises a similar question as to how instructional designs can bring about gains in conative and affective development simultaneously with gains in traditional student achievement. The purpose of this study was to examine the effect on both learner autonomy (specifically the *Resourcefulness* of the learner) and computer programming performance when a course originally designed for traditional computer programming performance outcomes was redesigned to address lifelong learning skills concurrently.

Research Questions

This study examined the effects of an instructional design intervention on both computer programming performance and learner autonomy skills simultaneously by exploring the following research questions:

1. As measured by pretests and/or posttests of Learner Resourcefulness, is there a significant difference in Learner Resourcefulness between students who receive traditional computer programming instruction and students who receive an instructional intervention that integrates Learner Resourcefulness training with computer programming instruction?
2. As measured by pretests and/or posttests of student achievement in computer programming, is there a significant difference in performance between students who receive traditional computer programming instruction and students who receive an instructional intervention that integrates Learner Resourcefulness training with computer programming instruction?

3. As measured by pretests and posttests, is there an interaction effect between the development of learner autonomy and computer programming achievement when each is pursued in conjunction with the other?
4. How do student perceptions of the concurrent training compare to the results shown in the collected data?

Research Design

This study was conducted using a Solomon four group design. This research design calls for multiple comparisons between groups to identify or rule out effects from the pretest. Oliver and Berger (1980) explained that the Solomon design "produced unambiguous treatment effects and posttest mean levels" (p. 470). The Solomon design summarized in Table 1 calls for a series of comparisons using ANOVA between groups C and D and groups A and B to determine the degree of effect of the pretest. Bracht and Glass (1968) determined that pretest effects may occur when self-reported measures are used. Willson and Putnam concluded although the effect size of pretests in general is small, it can be significant in some cases and should be examined as a general rule (1982). Other tests called for in the Solomon design include comparisons between the pretest of Group B and the posttest of Group D to check for temporal distortions, between the posttests of Groups A and C to evaluate any interaction effects between the pretest and the treatment, and between the posttests of Groups B and D to determine the effect of the pretest independently of the treatment.

Table 1.
Solomon Four Group Experimental Design with Random Assignment (Solomon, 1949)

Group	Sections	Random Assignment	Pretests	Treatment	Posttests
Group A	2, 4, 5	**R_1**	**OP_1, OA_1**	**X**	**OP_5, OA_3**
Group B	2, 4, 5	**R_2**	**OP_2, OA_2**		**OP_6, OA_4**
Group C	1, 3, 6	**R_3**	**OP_3**	**X**	**OP_7, OA_5**
Group D	1, 3, 6	**R_4**	**OP_4**		**OP_8, OA_6**

Where:
$R_1, R_2 \ldots R_4$ = random assignment into two treatment and two control groups.
X = the instructional intervention involving Learner Resourcefulness training.
$OP_1, OP_2 \ldots OP_8$ = Programming achievement assessment in pretest and posttest form.
$OA_1, OA_2 \ldots OA_6$ = observations of the Learner Autonomy Profile as a pretest and posttest.

The one agreed upon challenge of the Solomon design lies in the amount of complexity in the statistical analyses required, however modern statistical analysis software has greatly reduced this concern. Braver and Braver (1988) suggested a series of meta-analysis procedures for follow up on various finding conditions from the basic Solomon design. A few of their suggestions were challenged and alternative options for subsets of the follow up procedures were suggested by Sawilowsky and colleagues in subsequent publications (Sawilowsky, 2007; Sawilowsky, Kelley, Blair, & Markman, 1994; Sawilowsky & Markman, 1988). Procedures suggested in these publications were followed to implement the appropriate follow up analysis procedures for the results discovered in the study.

Course sections were assigned into groups based on the instructor in order to control for and to detect any instructor effects. Learners were then distributed into two experimental and control groups at random as shown in Table 1 above. The control groups (B and D) received the existing online course content which focused on developing basic programming techniques. The treatment groups (A and C) received an

online instructional intervention aimed at the same programming content but also included an instructional sequence in Learner Resourcefulness as a characteristic of autonomous learning and a lifelong learning skill. The delivery of course instruction, treatment, and data collection took place over a six week period.

The effects of the instruction and treatment were measured through either two separate assessments in a pretest/posttest design or through a posttest only design (A and B Groups then C and D Groups respectively). The first type of assessment measured student achievement gains through the regular course assessment in a pretest and posttest format. The second was a validated instrument called the Learner Autonomy Profile – Short Form (LAP-SF) from Confessore and Park (2004). The instrument contained sixty-six items and provided data on four factors and twenty-two subscales in total. Comparing the differences in the resourcefulness factor along with its seven subscales was the primary focus of the study. The other three factors measured by the instrument included desire, initiative, and persistence (see Confessore & Park, 2004). Based on a recommendation by the authors of the instrument, all four factors were assessed as a whole since the scoring method included weighting from all items in the assessment. Separate scores were reported for all subscales of each of the four conative factors. However, the scoring required that all sixty-six items were included in order to generate a valid index for any individual item.

Limitations

Threats to the internal and external validity of any instructional design are common. Due to the wide scope and scale of potential variables and conditions both internal and external to each learner in a higher education setting, it is possible that not all

significant data were accounted for in this study. Each learner brought a unique and varied background and set of conditions within their personal lives that could not be captured as data points or controlled by the researcher. Extensive experience in teaching this and related courses led the researcher and instructors to feel that the variability in learners tended to stay within expected bounds historically without any other major known variables or conditions that could reasonably be expected to interfere with or confound the design of this study other than those described in this section. Therefore, learners were assigned into the treatment and control conditions randomly and a sufficiently large sample size was selected in order to minimize the likelihood of this threat.

Campbell and Stanley's (1963) treatise on experimental and quasi-experimental designs identified eight factors that jeopardize the internal validity of various experimental designs. These factors include: history, maturation, testing, instrumentation, statistical regression, selection, experimental mortality, and selection-maturation interaction. Each of these threats were addressed in turn as follows:

- *History* refers to the potential for external events that can have confounding effects on the experimental variables. A simple two group design can minimize this threat as the comparison between control and treatment groups allows for the variables of interest to still be analyzed. The Solomon Four Group design provides this same ability for minimizing the effects of history threats.
- *Maturation* refers to the potential for natural processes in development or human processes that can have confounding effects on the experimental variables. In this case, the participants were adult learners who are typically more stable than

young or adolescent learners. While an individual learner may have experienced effects such as hunger or fatigue, the instruction and experimental treatment followed conventions of other course design and therefore minimized the potential for odd or confounding effects.

- *Testing* involves the potential for changes in performance due to repetition in testing otherwise known as becoming test-wise. The Solomon Four Group design was utilized to detect and quantify any such effects. Rather than try to eliminate the potential for such effects, the design allowed for the presence or absence of these effects to be detected and articulated.
- *Instrumentation* includes the possibility that the measurement formats or procedures could have complicating effects on the variables of interest. Instrumentation in the study included the Learner Autonomy Profile-Short Form, course assignments, and course assessments. The Learner Autonomy Profile-Short Form has been standardized and validated using a variety of methods and used in numerous prior studies as shown in chapter II. Course assignments and assessments were standardized across numerous sections of the course and have been used for several years with results that were deemed satisfactory to both the instructor committee of the course and the online learning groups involved in the development and review of the course. Grading results were gathered and inter-rater reliability scores were calculated to address the risk of miscalibration of the measurements between graders in the study.
- *Statistical regression* refers to a type of selection bias that can occur when assignment is made that includes separating or selecting participants into groups

based on extreme scores and then seeing those scores regress to the mean due to factors of instability in luck or error factors. The Solomon Four Group design and the random assignment to those groups minimized the potential for this threat.

- *Selection* involves the potential for bias resulting from the differences between comparison groups. When experiments compare the effects of instructional interventions between two groups of people, there are differences between those groups. However, random selection into the two groups as was used in this study tends to limit the potential for bias in these effects. Also, the Solomon Four Group design provided additional controls that helped focus on identifying the effects of the treatments and provided a means for describing potential causes for these biases to inform future studies.
- *Experimental mortality* is the potential for differential loss of respondents from the comparison groups. The study was positioned in the second half of the semester as the university policies for dropping courses tend to result in higher attrition rates during the first few weeks at the beginning of the semester than toward the end. Those who were considering dropping out were asked to self-identify and not consent to participate in the study.
- *Selection-maturation interaction* refers to the potential for differential rates of normal growth between the two groups during the period of study. Random assignment and the Solomon Four Group design helped to minimize this threat and provided a means to detect and report the level or degree of the effect if it does occur.

Delimitations

The external validity of an experimental study refers to the degree to which the findings of the study can be generalized to a wider population and environment than the target of the study. The current study addresses a direct instruction approach for both computer programming content which may limit the generalizability of the results when considering other types of instruction and other content areas. Bracht and Glass (1968) provide an extensive listing of threats to external validity. These include the representativeness of the experimental group or groups, the interaction of personological variables and treatment effects, characterization of the independent variables, multiple treatment interference, Hawthorne effect, novelty or disruption effect, experimenter effect, pretest sensitization, posttest sensitization, interaction of history and treatment effects, measurement of the dependent variable, and interaction of time of measurement and treatment effects. In general the environment and culture of the university in the study could be quite different from other institutions of higher education. As a result, the findings in this study may not fully generalize to larger or comparison populations. However, the intervention is targeted to address the population of other students expected to take the course at the university in the future. In this sense, the sample population was expected to reflect more closely the larger target population of learners who will take the class in near term (less than ten years) future semesters. Each of these external threats will be discussed in turn:

- *Representativeness of the experimental group or groups* refers to the degree to which the experimental groups reflect the characteristics of larger or comparison populations. The participants sampled for this study was limited

to a fairly homogenous demographic base of students enrolled in an introductory computer programming course at a private university in the Intermountain West region of the United States. The results of the study may not generalize well to populations with a higher degree of diversity.

- *Interaction of personological variables and treatment effects* involves the potential for a reversal of the effect if specific levels of a "variable descriptive of persons" are exposed to the treatment. The private, faith-based nature of the educational institution may limit the generalizability of the study findings. Due to the characterological nature of the study, it is possible that the results may not be replicable if the environment differs from a values-based, liberal arts setting. Two variables of interest regarding this threat to external validity include religious affiliation and the number of participants that participated in a service mission for sponsoring religion (a personological variable not as common to other higher education institutions).
- *Characterization of the independent variables* deals with the degree to which the treatment and experimental setting is made known. These details are explained in chapter III and were reviewed by a doctoral committee for completeness prior to the implementation of the study.
- *Multiple treatment interference* occurs when multiple treatments are involved in the design of a single experiment. This is a significant potential threat for instructional design research as multiple characteristics, attributes, and variables are woven together to create an instructional sequence. The threat was minimized by testing recommendations given by experienced researchers

in the field of instructional design. The scope of the research questions and study design were also reviewed by multiple instructional and research design professionals to screen for any known or anticipated interference effects.

- *Hawthorne effect* (also referred to as the observer effect) is a type of reactivity in which individuals modify or improve an aspect of their behavior in response to their awareness of being observed. As the participants in the study were asked for consent to participate in the study, a possibility for Hawthorne effects is present. Study participants may have thought or acted differently as a result of knowing they were part of the study. The Solomon Four Group Design and the separation of the instructional design from the instructor delivery helped to minimize this issue. The analysis of groups in this experiment will compare the control conditions to treatment conditions. Thus, all participants were exposed to the same instructor effects. The differences in conditions took place only within the learning management system and were out of the control of the instructor. Thus any claims of instructor or researcher enthusiasm effects were separated from interaction with the participants.
- *Novelty or disruption effect* occurs when the experimental results are caused or significantly influenced by the newness or unfamiliarity of the treatment. The implementation of the experimental components in the second half of the semester could present some degree of novelty or disruption effect. The six week timeframe of the study was selected with this in mind. It was assumed by the researcher that each learner was able to practice with the reflection elements of the course design long enough to lessen these effects as they

should become more accustomed to the process over this period. Also, the treatment was designed to match the existing course content and flow as much as possible in order to minimize this threat.

- *Experimenter effect, pretest sensitization* refers to the potential for the experimenter to have an effect that cannot be generalized. The introduction and presence of the researcher may increase experimenter effects. Thus, the bulk of the study procedures were conducted through the existing learning management system. The researcher documented and trained the existing instructors on all study procedures in order to lessen the potential for any of these effects. Interactions between each learner and the research study came through familiar technologies and instructors whose effects were quantifiable due to the design of the study.
- *Posttest sensitization* involves the potential for latent or incomplete treatment effects that can only be captured when a post-experimental test is administered. This study was designed to determine the effects of a treatment addressing dual outcomes during the training period. It is possible that posttest effects were present that went undetected. However, the study was designed to capture the immediate effects of the instructional intervention for the benefit of the target population of later students. Posttest sensitization effects were beyond the scope of the study.
- *Interaction of history and treatment effects* include external events that have an impact that would limit the generalizability of the results such as emotion-packed events, unusual student morale conditions, or local or national political

events. The researcher monitored for these effects and consulted with course instructors and the doctoral research design committee before, during, and after the study timeframe to capture and report any of these events. No events were deemed of sufficient significance to report.

- *Measurement of the dependent variable* involves the potential for the measurement of the dependent variable(s) to become generalizable. The Learner Autonomy Profile has been made widely available and validated in numerous studies. However, the performance measurements of the course applied more specifically to the computer programming subject matter of the course. These have been made consistent through the instructional design review process and validated over numerous semesters of use which will still be applicable for semesters in the foreseeable future. Inter-rater reliability measures were taken to capture the degree of generalizability of the scores.
- *Interaction of time of measurement and treatment effects* occurs when the effects of the treatment are not fully captured due to the timing of the measurements. While continuous monitoring and analysis of all variables are an ideal design in order to capture these effects, there are no known means for fully mitigating this threat. The treatment was designed to follow along with the assignment and data collection patterns of the course which include a weekly time frame for assignments and an asynchronous nature for the completion of tasks and interaction with course content and assignments. Data from the online course interactions were collected as near real-time as possible for contemporary information systems. Data quality evaluations and

follow up interviews with students were conducted within six weeks of the completion of the course in order to capture the student perspective.

Definitions of Terms

Affect: Huitt (1999) described affect as "the emotional interpretation of perceptions, information, or knowledge." For purposes of this study, affect is one of the three interrelated divisions of mental function and learning: conation, cognition, and affect that deals with feelings, emotions, and attitudes.

Autonomous Learning: "An agentive learning process in which the conative factors of desire, initiative, resourcefulness, and persistence are manifest" (Carr, 1999, p. xiii). It is the set of processes by which a learner exercises the will and other personal faculties to deliberately and self-sufficiently learn due to their own choosing and for the benefit of either themselves or a person, persons, or causes they care about rather than due to external pressures or forces.

Cognition: Refers to the process of coming to know and understand; the process of encoding, storing, processing, and retrieving information. It is generally associated with the question of "what" (e.g., what happened, what is going on now, what is the meaning of that information) in relation to a topic of interest (Huitt, 1999). For purposes of this study, cognition is the mental processing of information and reasoning functions that allow an individual to learn.

Conation: Huitt (1999) describes this as the connection of knowledge and affect to behavior and is associated with the issue of "why." It is the personal, intentional, planful, deliberate, goal-oriented, or striving component of motivation, the proactive (as

opposed to reactive or habitual) aspect of behavior. For purposes of this study, conation will be used in relation to the more commonly held definition as simply the will.

Lifelong Learning: All purposeful learning activity, whether formal or informal, undertaken on an ongoing basis with the aim of improving knowledge, skills, and competence (European Commission, 2000).

Reflection: The ability to think about one's self as an intentional subject of personal actions and to consider the consequences and efficacy of those actions. (Von Wright, 1992)

Resourcefulness: The behavioral syndrome of self-control skills requisite to autonomous learning. These include: prioritizing learning over other things, making choices in favor of learning when in conflict with other activities, looking to the future benefits of the learning undertaken now, and solving problems (planning, evaluating alternatives, and anticipating consequences) (Carr, 1999). One of four conative factors of autonomous learning: Desire, Resourcefulness, Initiative, and Persistence (Confessore and Park, 2004).

Self-directed learning: "In its broadest meaning, 'self-directed learning' describes a process by which individuals take the initiative, with or without the assistance of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implement appropriate learning strategies, and evaluating learning outcomes" (Knowles, 1975, p. 18). For purposes of this study, self-directed learning was also used as a linking construct between lifelong learning and autonomous learning.

Significance of the Study

In light of increasing institutional and educational reform emphasis on lifelong learning skills coupled with institutional and public demand for increasing quality of content specialization, this study examined the effectiveness of teaching both concurrently. It addressed the practical question of whether instruction in a targeted lifelong learning skill – Resourcefulness – would enhance or interfere with learning a content area skill – computer programming. Although many have called for research studies on the interaction and purposeful integration of conative factors with the more familiar cognitive elements of instruction, definitive experimental research has not been conducted to clarify the effects and interactions of specific, targeted lifelong learning skill training in conjunction with cognitive skill development at the higher education level.

As will be shown in Chapter II, Ponton, Carr, and Derrick (2004) argue that Learner Resourcefulness is a key skill in the development of autonomous learning capacity. The ability to become autonomous then strengthens and reinforces a learner's ability to become self-directed. By extension, these capacities for autonomous learning and self-direction have a firmly established theoretical connection with a learner's development as a lifelong learner. This creates a circular pattern described as the commitment pathway by Snow (1989). The assertion is based on the conative commitment continuum of Heckhausen and Kuhl (1985) and leads one to believe that just as cognitive models are built upon and refined through the recursive application of the scientific method, a learner's capacity for willful learning and persistence is refined over time and can be more fully developed through deliberate exercise.

CHAPTER II

Review of Literature

Research on lifelong learning is interrelated with numerous educational philosophies, psychological constructs, and instructional design efforts. The relationship between lifelong learning, self-directed learning, and autonomous learning will be explained. Numerous research studies have examined how to measure these constructs and how the constructs themselves influence one another. Other studies have explored how these measurements have been used to predict educational and performance outcomes such as grades and course satisfaction. Finally, how to design instruction to achieve these learning goals along with more traditional skill and knowledge-based outcomes will be reviewed.

Lifelong Learning

Lifelong learning as a concept dates back to the philosophers of ancient Greece, but has recently received renewed interest as a growing emphasis in both K-12 and higher education. The term directly denotes change and improvement throughout the lifespan of an individual. However, the more broad connotations of the term can be traced as far back as the ongoing educational path of the philosopher-kings in Plato's work *The Republic*, which started with reading, writing, counting, music, and sports at age six and continued on with further formal education in the teenage years, military, physical, and higher education in the early adult years, philosophy education and civil service from roughly age 30 to 50 and philosophical questioning, inquiry, and leadership after age 50. Smith (1996) traces the roots of the lifelong learning concept in the modern era back to the post-World War I reconstruction efforts in Great Britain (see Tight, 1996) on through

the works of Eduard Lindeman (1926) and Basil Yeaxlee (1929) into the modern usage starting with the Faure Report (1972) of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) International Commission on the Development of Education. The current widely accepted definition of the term is captured in a European Union Commission on Education memorandum (2000) which states "Lifelong learning is seen as encompassing all purposeful learning activity, whether formal or informal, undertaken on an ongoing basis with the aim of improving knowledge, skills, and competence."

Okamoto (1994), Methven and Hansen (1997), Jary and Thomas (1999), and others have written of lifelong learning as a more generalized movement or paradigm shift in institutions of higher education. One commonly accepted definition of paradigm (see Hyman, 2004; Kosicek, 2008; Stewart 2010) is "a philosophical and theoretical framework of a scientific school or discipline within which theories, laws, and generalizations and the experiments performed in support of them are formulated." In other words, a paradigm typically consists of the conscious and unconscious boundaries along with the targets, objectives, or outcomes of a way of thinking about bounded scenarios or problems within a domain of knowledge. With this in mind, one recent paradigm shift in education settings is the transition from a narrow focus on traditional knowledge and skill acquisition toward a more holistic end goal of preparing students for lifelong learning. This shift is evidenced by the changes in mission statements of higher education institutions in recent years. In 2005, Kreber & Mhina reported that 69% of institutions showed evidence of the lifelong learning movement in their mission statements. Of the fourteen well-recognized higher education institutions with

headquarters or primary campus locations registered in the state of Idaho, seven include lifelong learning as a specific element of their mission (see Appendix A). All but one of these institutions (or 92%) include language that shows the influence of the lifelong learning movement in their mission and vision statements as of early 2015. A more inclusive review included thirty institutions of higher education registered with the state of Idaho showed that sixteen included explicit statements regarding lifelong learning as part of their mission (53.3 percent) and twenty-four (80 percent) included at least some evidence of the lifelong learning movement in their mission and vision statements. This trend is also reflected in the growth of professional academic journals on the topic such as the International Journal of Lifelong Education which started in 1982, the PAACE Journal of Lifelong Learning in 1992, the Journal of Widening Participation and Lifelong Learning in 1999, and the International Journal of Continuing Education and Lifelong Learning in 2008.

Lifelong Learning, Self-directed Learning, and Autonomous Learning

The growth in popularity of the lifelong learning paradigm brings along with it a host of terminology from education and psychology research. Such terms in the literature include becoming a self-directed learner (Knowles, 1975; Oddi, 1987; Ponton, Carr, & Confessore, 2000), an autonomous learner (Knowles, 1970; Confessore & Park, 2004; Merriam, Caffarella, & Baumgartner, 2012), or a resilient and robust learner (see Crick, Broadfoot, & Claxton, 2004). These concepts are often intertwined and commonly packaged with descriptions of lifelong learning (Candy, 1991; Grow, 1991; Goodyear, 2002). These terms and ideas are related to one another through the common theme of recognizing the opportunity for a learner to take ownership over his or her learning

process and in developing the desire and attitude of openness toward making more of oneself.

In examining the types of relationships implied by the conceptual language of lifelong learning in the literature, hierarchical relationships emerge as the common format as will be demonstrated in the following paragraphs culminating in Figure 1 below. Tough (1967), Knox (1974), and Knowles (1970, 1975) appear to be among the first to discuss connections between self-teaching, self-directed learning, and lifelong learning. Later, Oddi (1987) was more explicit in building upon Bunting, Moon, and Peterson (1978), Brockett (1982), and Cheren (1983) in characterizing self-directed learning as a subset of lifelong learning. Candy (1991) dedicated an entire book to self-directed learning and described it as a major subcomponent of lifelong learning. These writings establish a subsuming, hierarchical relationship between concepts where each new term serves to refine the scope and scale of learning from a lifelong perspective.

As early as 1967, Baird and Webb discussed the relationship between self-directed learning formats and learner autonomy. Moore (1972) continued the development of the relationship between learner autonomy and self-directed learning formats focusing mostly on independent study courses. Wenden (1991) addressed the issue of learner autonomy from a learner-centric and instructional design perspective. However, Confessore (1992), Carr (1999), and later additional publications such as Ponton and Carr (2000), Derrick and Carr (2003) more clearly defined learner autonomy (or autonomous learning) as an attribute of self-directed learning and self-directed learning as a subcomponent of lifelong learning as shown in Figure 1. The measurement of learner autonomy has emerged from four separate instruments measuring desire,

initiative, resourcefulness, and persistence that have been combined into a single evaluation system (Confessore & Park, 2004; Derrick, Ponton, & Carr, 2005).

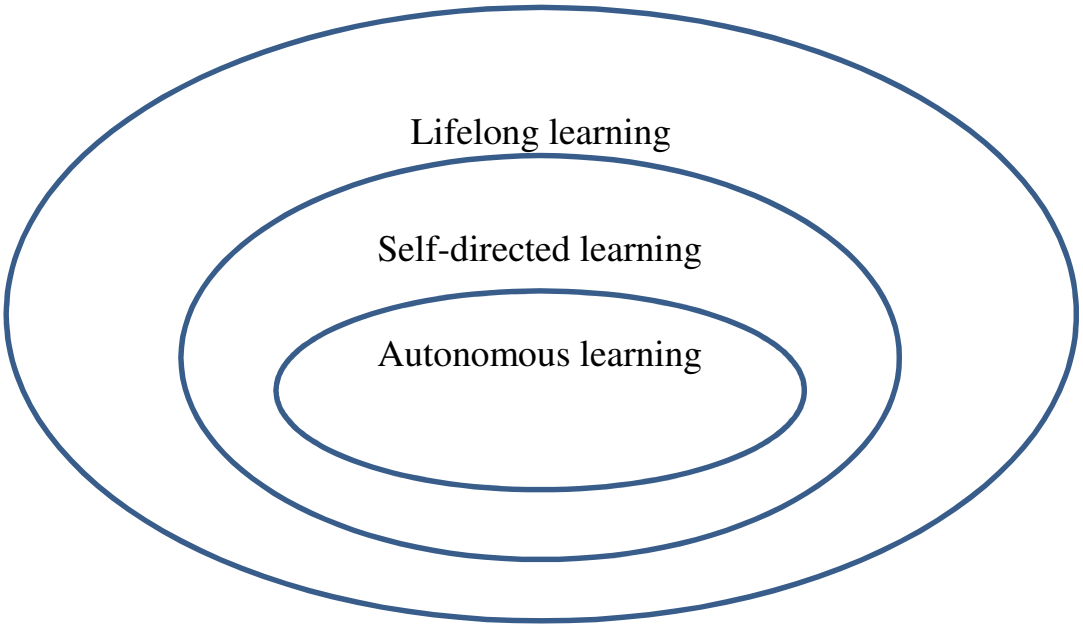

Figure 1. Hierarchical Relationships in Lifelong Learning. This figure illustrates the hierarchical, subsuming relationships of autonomous learning, self-directed learning, and lifelong learning described in the literature.

Measurements of Lifelong Learning and Learner Autonomy

The lifelong learning movement has produced efforts to quantify and measure both organizations and individuals against various definitions and psychological constructs associated with the movement. For example, the European Commission (2002) developed fifteen quality indicators at the national level to help track and compare member states in their efforts to support and provide for lifelong learning from a policy, program, and infrastructure perspective. Crick, Broadfoot, and Claxton (2004) developed a self-assessment instrument targeted at seven dimensions of "learning power", entitled the Effective Lifelong Learning Inventory (ELLI). The measurements were developed by creating an extensive set of detailed questions and then validated using a Principal Component Analysis technique to aggregate the scores into five and later revised into

seven conceptually and mathematically unique categories. In a more discipline-specific application, Hojat et al. (2005) developed and tested the Jefferson Scale of Physician Lifelong Learning (JSPLL) to assess the continuing professional education of actively practicing medical professionals. Confessore and Park (2004) developed and validated the Learner Autonomy Profile (LAP) instrument to measure Learner Desire, Initiative, Resourcefulness, and Persistence as four primary characteristics of an autonomous lifelong learner. A mapping of the conative factors and dimensions assessed through these lifelong learning and autonomous learning instruments is shown in Table 2 below.

Table 2

Mapping of Dimensions and Conative Factors Assessed in Lifelong Learning Instruments

Effective Lifelong Learning Inventory (ELLI) *Crick, Broadfoot, & Claxton, 2004*	**Jefferson Scale of Physician Lifelong Learning (JSPLL)** *Hojat et al, 2005*	**Learner Autonomy Profile** *Confessore & Park, 2004*
Growth orientation Critical curiosity	Intrinsic motivation Extrinsic motivation Research interest	Desire
Dependence and fragility		Persistence
Creativity	Research interest	Initiative
Relationships/Interdependence Strategic awareness	Information seeking skills	Resourcefulness
Meaning making		

The mapping indicates that Resourcefulness and Initiative have the cleanest one-to-one relationships across all three instruments. However, the Research Interest dimension of the JSPLL is split across both the Desire and Initiative factors due to the nature of description of that factor having features that blend across both. Thus, Resourcefulness appears to be the cleanest representative factor across these instruments. Resourcefulness has also been shown as a key factor in the development of autonomous and lifelong learning according to a path analysis performed by Ponton, Carr, and Derrick

(2004). In this study, Resourcefulness had the strongest and most significant effect on the development of persistence in autonomous learning based on a linear regression analysis.

Of the three instruments evaluated, the Learner Autonomy Profile has the most robust and detailed definition of Learner Resourcefulness defined by seven subscales: learning priority, deferring gratification, resolving conflict, future orientation, planning, evaluating alternatives, and anticipating consequences (Confessore & Park, 2004). These seven subscales have been mapped to corresponding elements in the ELLI and JSPLL instruments in Table 3 below. The other two instruments are not as formal in their distinctions and labeling of sub-elements of Resourcefulness. However, the literature does provide descriptions that point to similarities in the ideas and concepts that comprise strategic awareness as well as interdependence or relationships in the ELLI. Need recognition and information seeking skills map well to the learning priority and planning, evaluating alternatives, and anticipating consequences elements of the LAP subscales. It is also important to note that the strategic awareness element of the ELLI brings out reflection, self-evaluation, and the ability to talk about themselves as a learner as factors that relate to Learner Resourcefulness.

Table 3

Mapping of Learner Resourcefulness Assessed in Lifelong Learning Instruments

Learner Autonomy Profile *Confessore & Park, 2004*	**Effective Lifelong Learning Inventory (ELLI)** *Crick, Broadfoot, & Claxton, 2004*	**Jefferson Scale of Physician Lifelong Learning (JSPLL)** *Hojat et al, 2005*
Learning Priority	Strategic awareness: aware of themselves as learners and use that awareness to manage learning processes	Need recognition: recognition of the importance of continued awareness and monitoring of new research findings for professionalism as a physician.
Deferring Gratification	Strategic awareness: using their awareness to manage learning processes	
Resolving Conflict	Strategic awareness: know how to repair their own emotional mood when they get frustrated or disappointed Relationships: Balance social and private learning	
Future Orientation	Strategic awareness: aligning awareness of their learning goals with learning processes	
Planning	Strategic awareness: like being given responsibility for planning and organizing their own learning; can judge how much time, or what resources, a learning task will require. Relationships: Balance social and private learning	Information seeking skills: proposing grants, searching, reviewing, creating and/or editing journal papers and/or conference presentations
Evaluating Alternatives	Strategic awareness: identifying and evaluating ways to "get around the problem". Relationships: Balance social and private learning	Information seeking skills: proposing grants, searching, reviewing, creating and/or editing journal papers and/or conference presentations
Anticipating Consequences	Strategic awareness: can judge how much time, or what resources, a learning task will require Relationships: Balance social and private learning	Information seeking skills: proposing grants, searching, reviewing, creating and/or editing journal papers and/or conference presentations

Factors and Subscales of Learner Autonomy

Derrick, Ponton, and Carr (2005) define and describe learner autonomy in terms of four factors and twenty-two subscales (see Table 4 below). *Desire* is comprised of seven subscales: Circumstance, Expression, Group Identity, Growth and Balance, Love Issues, Communication Skills, and Change Skills. *Initiative* consists of five subscales: Goal-Directedness, Action-Orientation, Overcoming Obstacles, Active-Approach, and Self-Startedness. *Resourcefulness* consists of seven subscales: Learning Priority, Deferring Gratification, Resolving Conflict, Future Orientation, Planning, Evaluating Alternatives, and Anticipating Consequences. The final factor, *Persistence*, has 3 subscales: Volition, Self-Regulation, and Goal-Maintenance. Each of these were derived by Derrick et al. in a top down approach by breaking the factor down into theorized component elements, developing survey items for self-assessment instruments, and then validated through multiple rounds and formats of quantitative testing and analysis.

Table 4

Factors and Subscales of Learner Autonomy (from Derrick et al., 2005)

Factor	**Subscales**
Desire	Circumstance
	Expression
	Group Identity
	Growth and Balance
	Love Issues
	Communication Skills
	Change Skills
Initiative	Goal-Directedness
	Action-Orientation
	Overcoming Obstacles
	Active-Approach
	Self-Startedness
Resourcefulness	Learning Priority
	Deferring Gratification
	Resolving Conflict
	Future Orientation
	Planning
	Evaluating Alternatives
	Anticipating Consequences
Persistence	Volition
	Self-Regulation
	Goal-Maintenance

Study Findings based on the Learner Autonomy Profile

A growing number of studies have made use of the Learner Autonomy Profile (LAP) instrument in a variety of ways. As will be shown in further detail in the remainder of the chapter, the majority of studies use the LAP as a data collection instrument prior to a learning intervention or to test the LAP results as a predictor of other learning outcomes such as grade point average across courses, individual course performance, retention, or course satisfaction. A few studies include instructional design issues such as comparing online formats with traditional face-to-face formats, or asynchronous instructional modes with synchronous modes. Still others have used the LAP instrument to gather learner

characteristics prior to an instructional intervention or to identify differences in demographic attributes.

Learner Autonomy Profile Correlations and Predictive Power

Derrick, Rovai, Ponton, Confessore, and Carr (2007) examined data from over 2,000 LAP respondents to identify differences in learner autonomy by gender, marital status, and prior educational attainment. Findings of the analysis include a slight (very small effect size), but statistically significant decrease in learner autonomy scores for married versus single males, a slight increase in learner autonomy scores for married versus single females, females with greater Resourcefulness scores than males, and those with bachelor degrees as the educational attainment group with the lowest learner autonomy scores when compared with high school and graduate student groups. All of these findings highlight the importance of attending to learner autonomy as an educational outcome for undergraduate programs with a sizeable population of married males.

The large sample size of the demographic analysis means that the results can be more reliably generalized. However, the effect size in these studies was shown to be rather small (partial eta squared, or η^2, ranged between .007 and .012). Since the study included a variety of learners at all different stages of education and life experience, the study had a general approach that could be considered less relevant when planning an instructional intervention. However, a similar demographic analysis may still yield relevant results when used to help frame and guide an instructional intervention in a more targeted context.

Park, Christmas, Schmaltz, and Durso (2006) incorporated the LAP in a study on an intensive course on teaching geriatrics to clinician-educators. The LAP was used as a diagnostic tool for both the course instructors and to facilitate learner construction of learning objectives for the adult education course. The sample size of this primarily qualitative study was small (n=10), but confirm that those with graduate level education had higher levels of autonomy. Also, the results indicated that greater learner autonomy was associated with better short-term outcomes, but did not guarantee longer-term outcomes. Finally, the LAP scores in this study correlated to a positive, high linear degree with interest in teaching skills and on how the participants valued geriatrics. In other words, higher levels of autonomy correlated with higher levels of both interest in teaching and with valuing geriatrics knowledge in practice. Whether the development of higher levels and correlations were mutually reinforcing or not was not addressed in the study. The authors also did not address how to increase autonomy in low autonomy learners in the study, but referred to Grow (1991) in calling for a strategic match between the learner's stage of self-direction and the teacher's methods in order to prepare the learner to advance to higher stages.

In a doctoral dissertation, Lowe (2009) examined correlations between overall LAP scores, factor scores, and the subscales with Grade Point Average (GPA). While the correlation coefficients were rather small (Pearson correlation coefficients ranged between .186 and .275 on statistically significant correlations), the four conative factors were all found to be statistically significant at the .05 level. Of those four, Resourcefulness was the only factor found to be significant at the .01 level. Lowe's study identified the predictive capacity of the LAP prior to course experiences and the

subsequent grades received by students upon completion of the course. One point of interest in this study is that of the 2,682 students contacted for the study, only 135 completed the survey and self-reported the cumulative college GPA data used for the study. This raises questions of possible bias from those that responded and questions of data quality in the data collected. Also, the respondents came from multiple levels of completed formal education (high school = 50, Bachelor = 48, Graduate/Professional = 37) and data analyses were not performed in relation to these categories. All correlations examined in the study were positive and indicate that "changes in the LAP-SF elements track consistently with GPA and may be due to the fact that LAP-SF elements in general are good predictors of success at any endeavor – it also points to an interesting topic for further research" (p. 96). Lowe also points out that "further study is required to best understand how the two [GPA and LAP elements] relate and to what extent they influence each other" (p. 103).

Ng, Confessore, Yusoff, Abdul Aziz, and Lajis (2011) performed a similar study comparison between academic performance and LAP scores among pre-diploma students at a Malaysian university. The authors found that Resourcefulness was the only factor of the four that was significant at the .05 level with predictive capacity for English grades, Math grades, and GPA in the pre-diploma program. Additional t-tests of LAP scores against grade data in this study found that Resourcefulness correlated significantly with English grades and GPA. As with the Lowe (2009) study, the data collected was a single snapshot in time and didn't evaluate how these academic performance measures and LAP scores change over time or what might cause changes over time. According to a number of other studies, intelligence of all kinds including cognitive, affective, and conative such

as academic performance and LAP scores should be considered "plastic" or changeable within a learner before, during, and after a course experience (Adey, Csapo, Demetriou, Hautamaki, & Shayer, 2007; Garlick, 2002; Snow, Corno, & Jackson, 1996; Pay, 1981).

Other studies involving the LAP as a predictor have examined the relationship with degree program retention and student satisfaction. Buvoltz, Powell, Solan, and Longbotham (2008) found that while the LAP alone was not a predictor of retention, LAP scores for Resourcefulness and Initiative in conjunction with emotional intelligence scores on self- management, relationship management, and communication were able to correctly categorize retention in a degree program for 90% of the sample with a significance of $p = .045$. Similarly, Ng and Confessore (2010) examined relationships between the LAP instrument and the Grasha-Riechmann Student Learning Styles Scales (GRSLSS) and found that total LAP scores had strong, positive correlations with participant, collaborative, and independent learning styles for students in Malaysia. Both instruments had to go through translation processes and the question of cultural differences between these students and those in other areas of the world have yet to be explored. Sanders (2006) examined the relationship between various learner attributes and student satisfaction and found that none of the major constructs of learner autonomy were statistically significant in predicting student course satisfaction ($p = .22, .22, .21, .21$ for Desire, Resourcefulness, Initiative, and Persistence respectively). The level of course structure-dialogue, or interactions between students and between students and instructors, was found to be the only significant factor in predicting student satisfaction in the study. Again, all of these studies were designed with LAP scores collected once and then compared with the outcomes of interest.

Learner Autonomy Profile and Instructional Design Studies

The Learner Autonomy Profile has also been used in a number of studies that examined various instructional design variables. These studies included comparing online environments with face-to-face settings, synchronous and asynchronous modes within online courses, and educator control versus learner controlled environments. These studies can be used to help inform design decisions in each of these scenarios.

Derrick, Ponton, and Carr (2005) administered the LAP in a study designed to examine the differences in learner autonomy for doctoral students in online or face-to-face environments. This is one of very few studies where the LAP has been used both before and after a course experience to measure the changes within learners throughout the instructional sequence. Although the sample size was extremely small (twelve online students and six face-to-face students who completed the instrument at both the beginning and end of the course), the results showed that online students had higher LAP scores than face-to-face students on both pre- and posttests. However, the preliminary results were bothersome since learners decreased in all factors and overall scores with the exception of the desire factor for online students. The authors pointed out the need for these results to be validated through further studies due to the difference in sample size in the pretest and posttest conditions (twenty-seven down to twelve online and eighteen down to six face-to-face). The observed decline in autonomy scores and the attrition rates give rise to questions as to whether these results should be considered valid and how they would play out in a more stable environment, at different educational levels, or with different course matter.

Carlson, Wyatt, and Davis (2003) included the Learner Autonomy Profile when they published preliminary results for a study that split learners into three groups: traditional face-to-face (synchronous), first time online (asynchronous), and repeater online (asynchronous). While the nineteen first experience online, fifteen traditional, and six repeater online learners fell well short of the hoped for thirty-five, seventy, and thirty-five participants in each respective group, the researchers reported no difference between the groups at the factor level. The self-startedness subscale of the Initiative factor was found to be significantly higher in the first experience online students. The small sample size, preliminary nature of the results, and timing (when online learning was still relatively new at the university in question) indicate that a similar study should be performed to verify the results.

Integration of Learning Outcomes at the Course Level

Numerous educators and researchers have pointed to the importance of striking an appropriate balance when striving to achieve a holistic approach to learning and teaching. Similar calls for integration and balance occur throughout the arts and nearly every area of human endeavor (Jenkins, 2014; Dai & Sternberg, 2004; Birren & Fisher, 1990). Covey (1989) brought this to light as a general human and organizational challenge when he speaks of the inadequacy of training people in techniques while neglecting the development of the accompanying characterological traits. As noted previously Merrill, Li, and Jones (1991) have echoed that call specifically for the instructional design field. However, what to balance and more importantly how to seek out the balance and how to determine whether the balance has been achieved is often left unclarified.

Sternberg's (2001) Balance Theory of Wisdom in Educational Settings is representative of many others (such as Baltes & Staudinger, 2000; Kramer, 1990; Labouvie-Vief, 1990; Martin & Briggs, 1986) who have called for increased balance and integration in instructional sequences and settings. A key element of Sternberg's work was to point out the importance of unifying tacit knowledge (indirect, informal, inferential, or "street smarts") with explicit knowledge (direct, formal, factual, or "book smarts"). Sternberg and others have developed recommendations for instructional patterns to achieve Successful Intelligence and triarchic abilities (e.g. analytical, creative, and practical capacities and learning patterns) for elementary, middle school, and high school students (see Sternberg, 1995; Sternberg, Torff, & Grigorenko 1998; Sternberg, Grigorenko, Ferrari, & Clinkenbeard, 1999; Grigorenko, Jarvin, & Sternberg 2002; Sternberg, Lipka, Newman, Wildfeuer, & Grigorenko, 2006; Sternberg & Grigorenko, 2007). These studies have demonstrated a link between aiding students to develop in creative, analytical, and practical capacities and significantly improving scoring on standardized, memory-based and performance based assessments. Sternberg's theories have further been implemented and validated for admissions purposes and used to predict performance in college classes as measured by grades. However, these instructional methods, such as the WICS (Wisdom, Intelligence, and Creativity Synthesized) approach, have not been applied to lifelong, self-directed, or autonomous learning models or empirically tested in higher education contexts.

Other psychologists have called for integrated and holistic educational approaches claiming that increased richness is needed for more complete development of a learner. Ritchhart (2001) calls for instruction "to proceed on many fronts simultaneously."

However, the operationalization of this earnest desire seems to be a persistent challenge (see Brown, 1991; Kohn, 1999; Langer, 1997; Sizer, 1984). Several teachers have experimented with techniques and documented preliminary results and impressions as they seek to operationalize Claxton's "split screen" teaching metaphor (see Fawcett, 2012; Buckley, 2013). Their web log posts seem to reflect the enthusiasm of beginning the attempts in the early stages, some of their early design attempts, early successes and failures from the teacher perspective, but without as much follow up on the perspective and results of learners over the duration and after the instructional period.

On the opposing front, Cognitive Load Theory indicates that increasing richness can also have potentially inhibiting effects if not pursued carefully (Chandler & Sweller, 1991). Studies involving this theory tend to agree that germane load is beneficial and extraneous load is detrimental. However, the determination of what qualifies as germane and what qualifies as extraneous is not clear in many cases.

Summary of the Literature

Significant progress has been made in the development of the lifelong learning concept (Smith, 1996), movement (Okamoto, 1994; Methven & Hansen, 1997; Jary & Thomas, 1999), theories (European Union, 1972, 2002), and the definition and articulation of learning-to-learn outcomes. The link between and the measurement of lifelong learning with self-directed and autonomous learning has also been established as a hierarchical relationship (see Ponton & Carr, 2000; Derrick & Carr, 2003). This has laid a groundwork for exploring means by which learners can progress toward building resourcefulness, autonomy, self-directedness, and lifelong learning characteristics. Additionally, the literature continues to call for more integrated approaches to

instructional design research. Isolation of theories, concepts, ideas, and practices is often necessary in examining, decomposing, and gaining understanding of how instructional practices function in controlled environments. However, how these factors fit together, interact with one another, and influence a variety of outcome types beyond learner performance as measured by grades is needed to provide a more complete picture of learning paths and instructional methods for the benefit of learners, instructors, and instructional designers.

CHAPTER III

Method

Introduction

The purpose of this study was to explore the effects of blending both instruction targeted at the development of knowledge and performance of introductory computer programming with Learner Resourcefulness as a lifelong learning skill. In this section, the method for planning, carrying out, and interpreting the results of this research study are presented. The specific questions addressed by this study were as follows:

1. As measured by a pretest and posttest of Learner Resourcefulness, is there a significant difference in Learner Resourcefulness between students who receive traditional computer programming instruction and students who receive an instructional intervention that integrates Learner Resourcefulness training with computer programming instruction?
2. As measured by a pretest and posttest of student achievement in computer programming, is there a significant difference in performance between students who receive traditional computer programming instruction and students who receive an instructional intervention that integrates Learner Resourcefulness training with computer programming instruction?
3. As measured by the pretests and posttest, is there an interaction effect between the development and Learner Resourcefulness and computer programming achievement when both are pursued in conjunction with one another?

Research Design

Participants

The subjects in the research study consisted of 120 participants who consented to participate out of a total potential pool of 186 students enrolled in six sections of an introductory computer programming course at a private, religion-sponsored institution of higher education located in the Intermountain West of the United States. Some course sections met in a hybrid learning environment with course content and materials provided via traditional face-to-face lecture format and online materials distributed through a learning management system. Other sections were presented in a purely online format with course content and materials delivered through the same learning management system and supported by an online instructor who interacted with students through the learning management system and other electronic means such as e-mail and video conferencing.

Over the last year, about 46% of the students enrolled in the course fell into the traditional 18-24 age range for higher education students, and another 35% were between 25-35, with the remaining 18% outside of those two age groups. Over 73% of students were white, with roughly 9% claiming two or more ethnic origins, and 7% Hispanic or Latino. Over 45% of students in the course were married, while just over 70% were male. Finally, over 99% were affiliated with the institution's sponsoring religious organization. The demographics for this course in the past year differed from general university demographics in that there are higher rates of 25 to 35-year-old (35% v. 15%), male (70% vs. 50%), and married (45% vs. 25%) students with a slightly increased level of diversity (fewer white students and more Hispanic, Black/African American, Asian/Asian

American, Pacific Islander, and Two or more ethnic groups) enrolled in the course. The level of religious affiliation in the course reflects the demographics of the university.

Statistical Power and Sample Size

Cohen (1992) provided sample calculations for statistical power and effect size for different statistical tests. These included t-tests for two independent means and one-way analysis of variance (ANOVA). Effect sizes for t-tests of means were classified as small (d .20 < .50), medium (.50 > d > .80) and large (d > .80). Cohen identifies a statistical power level of .80 as a workable expectation in comparison to an average of .25 found from a meta-analysis of 54 psychology articles reviewed by Sedlmeier and Gigerenzer (1989). In order to demonstrate a medium effect size for a t-test of means with .80 power and an alpha level (α) of .05 requires a sample size (*N*) of at least 64 for each group (128 total). Demonstration of a small effect requires an increase in sample size up to 393 for each group (786 total). A typical one-way ANOVA test with similar target values for alpha (α = .05), medium effect size (d > .50), and power (> .80), would require a sample size of 45 (*N*=45) for four groups (180 total). Small effects for a similar four group ANOVA increases sample size requirements up to 274 for each group (1,096 total).

At the target university, only a handful of instructors taught more than one section of the course. This was due to a rapid growth in online education and online, part-time instructors teaching those courses. Only six of the available fifteen sections could be included in the study and still allow for an examination of instructor effects. Enrollment caps on the course are set at 30 in order to increase instructor-to-student interactions. Thus, the available sample size for the study was expected to have an upper ceiling of

180. Attrition rates in other studies at the target university were around ten percent when using an opt-out model for study consent. If similar rates held true in this study, the total number of participants would have been over 160. While this was slightly below Cohen's generalized recommendations for a .80 power level, it is important to note that power calculations can also be contingent upon whether the sample sizes are equal, data set correlation levels, statistical analysis methods, and deviations from the hypothesized effect size such as the difference between the means and standard deviations of the observed variables. Many of these considerations provide opportunities to meet or very nearly approximate Cohen's "rule-of-thumb" standards (1992, p. 156). Also, it is relevant to point out that Cohen was not supportive of the "objective, mechanical, and clear-cut go-no-go decision straddled over $p = .05$" mindset of the Fisherian null hypothesis testing (p. 156). According to Peng, Long, & Abaci (2012), including power analysis prior to the study, calculating the observed power and interpreting the results is still an improvement over the 98% of educational studies between 2005 and 2010 that didn't follow this recommended approach.

Sampling

Students were assigned to the pretest (Groups A and B) and no pretest (Groups C and D) conditions based on instructor in order to control for the effects by instructors (see Table 1 of Chapter I). Fifteen total sections of the course were taught during the semester of the study. Of these, six sections were selected as these had three instructors who taught two sections. This provided control for the effects of the instructor. Nine of the sections were removed since the instructors only taught one section and could not be matched in the study design. Once sections were assigned, students were randomly selected for the

control and Resourcefulness instructional treatment conditions. All students were given informed consent forms as shown in Appendix B to explain their roles and responsibilities in the study and to obtain individual consent. It was anticipated that there would be a very small number of students who would opt out of the study at this point based on studies performed at the institution previously. However, an opt-in model was required in this case. Ramifications of this requirement will be shown and discussed in later chapters.

Procedures

This section describes the experimental treatment and the process followed in developing the instructional modules.

Experimental treatment

Six learning modules addressing the use of common programming patterns in an introductory computer programming course were previously created, reviewed, and approved for use in both face-to-face and online delivery formats. The intended course outcomes for the instructional modules were to help students gain experience with using these patterns to create automated solutions. However, at the same time a similar university level outcome that overarches this learning endeavor states that a primary element of the university mission is to "prepare students for lifelong learning." In consultation with the course instructors, Learner Resourcefulness was identified as the lifelong learning skill that would integrate best with the intended outcomes of the course, program, and university.

Development of the Instructional Modules

The course content has functioned for several years with minor improvements to the content and delivery mechanisms on an as-needed basis. This content was developed by a department team of three faculty members for use in traditional face-to-face courses. This same content was reviewed and approved through the university's online course development department for use in online sections as well. By university policy, the content and outcomes between traditional face-to-face and online courses are to remain as similar as possible. Therefore this course content was "frozen" for a period of two years during which only minor changes (such as grammatical corrections) were made. The university has since relaxed this stance and instituted a change control process where changes to course content are reviewed and changes must be approved by a course council consisting of the course lead, course instructors, and an online learning representative. The established course content was created and prepared to target student achievement outcomes such as the ability to use common programming patterns to create solutions to programming problems. Thus, the focus for development was to integrate Learner Resourcefulness instructional elements with the existing course materials in the hopes of bringing about mutually reinforcing outcomes. The revised version of the course was given to the treatment groups (Group A and Group C).

The instructional design process as outlined by Gagne et al (2005) was used as a guiding framework governing the development of the integrated outcomes revision of the course. The instructional elements targeting the development of Learner Resourcefulness and lifelong learning primarily followed the autonomy and reflection features advocated

by Dunlap and Grabinger (2003). These features were infused and integrated throughout various stages of the learner experience and instructional sequences of the course.

The timetable for the project appears in Table 5 below and outlines the five major stages of the ADDIE framework (ref) which will be discussed in further detail below. As the integrated approach is an emerging concept, the ADDIE framework for organizing the project management plan was deemed flexible enough to be able to deal effectively with the new approach without having the design process constrain the study (See Appendices C-M for further detail).

Table 5

Timetable for the Instructional Design Project

Phase	**Procedure(s) Involved**	**Begin Date**	**End Date**
Analysis	Work with course developers, instructors, and experts to determine appropriate instructional outcomes, content, and delivery mechanisms based on student needs along with course, program, and university outcomes.	Dec 2014	May 2015
Design	Use developer, instructor, student, and research input to design computer-based instructional interactions. Develop pretest and posttest instruments and obtain licensing rights to make use of the Learner Autonomy Profile instrument to measure Learner Resourcefulness.	Jan 2015	May 2015
Development	Develop the computer-based instructional modules.	Jan 2015	Jul 2015
Implementation	Instructional modules pilot tested, revised, and delivered to study participants	Jul 2015	Nov 2015
Evaluation	Pre- and posttest assessments and Learner Autonomy Profile instrument were given and data were collected and analyzed. Evaluation of research study was completed.	Jun 2015	Feb 2016

Analysis Phase

In consultation with the course developers and instructors, the concept of the integrated approach to teaching was described. Recommendations for course content where students seemed to struggle or could benefit most from this type of approach was sought from the perspective of instructors who had taught the course numerous times. The course instructors readily identified two course modules on the implementation of functions and the second on the use of arrays as concepts that seemed to provide appropriate course content where each learner could benefit from seeking out additional helps and resources to be able to master the targeted knowledge and skills. Course instructors explained that they spend more time and energy coaching and encouraging students with these concepts and stated that students seem to need more practice with these concepts before becoming proficient with them. One instructor speculated that it may be that helping students understand their own learning process and how to bring more resources to bear upon the learning challenge at hand might be just what the learner needs at that point of the course. Three other course modules leading up to the targeted modules were selected in order to help the learner develop a learning habit prior to these target modules.

Learner Characteristics. A course demographics report was created to identify class standing, age, race, gender, ethnicity, and marital status. As this is often the first course for Computer Information Technology major and minor programs, it is anticipated that the majority of students will not have prior related course work from the perspective of the university that would be of significance. However, students will likely have a wide

range of interest, knowledge, and experience with computer environments and programming that they will have gained from formal, informal, and non-formal learning environments. The study will take place toward the end of the semester where students will have the opportunity to be on more of an even level of exposure to programming concepts.

Learning Hierarchy of Prerequisite Skills. The relationships among the individual programming concepts have been defined, validated, and implemented into the course previously through the university development and approval process. A separate learning hierarchy describing the relationships among Learner Resourcefulness subscales was developed and is shown in chapter two. These hierarchy maps were analyzed to identify any potential positive or negative interactions between the two sets.

Learning Influences. Qualities that were likely to influence learning were identified and documented. These qualities included strategies for gaining and maintaining attention, eliciting participation, accommodating learning disabilities, and many others. These qualities have been captured in further detail in Appendix F.

Requirements of the Learning Environment. As this was a computer-based instructional module, each learner needed sufficient computing resources in order to participate. The university has instituted a laptop initiative in recent years that has ensured that all students at the university either own, rent, or have ready access to a personal laptop that meets minimum performance specifications. The university also makes a web-based learning management system (LMS) available for all courses. Students use this LMS for all courses, so students typically become comfortable and proficient with navigating the system within their first year. Two other requirements of

the learning environment include the use of video content and JavaScript within the LMS. The study took place in the latter half of the semester in order to allow more time for newer students to become familiar with these technologies and the interface of the LMS before the study started.

Instructional Goal. The instructional goal relating to the university mission (Mission Statement, 2001) was stated as, "The mission of the university is to… 3. Prepare students for lifelong learning, for employment, and for their roles as citizens and parents." This goal was integrated with the existing course goal of developing introductory-level computer programming knowledge and skills. The instructional materials are focused on helping the learner develop Learner Resourcefulness habits.

Instructional Objectives. The objectives of the Resourcefulness training were to help each learner: 1) Improve internal and external learning Resourcefulness as measured by the Learner Autonomy Profile – Short Form (LAP-SF). These objectives were integrated with the exiting course objectives for the instructional modules which states that each student will do the following: Develop and debug a JavaScript computer program using the three basic programming control structures (sequence, selection, and repetition), functions, and arrays.

Concept Map. A concept map relating to the development of Learner Resourcefulness was developed based on the research literature (see Confessore & Park, 2004; Crick, Broadfoot, & Claxton, 2004). This concept map is available in Appendix N.

Delivery Options and Learner Constraints. Delivery vehicles for the scope of the study included the LAP-SF instrument published on the HRDE website, the course learning management system for course content, assessments, and feedback mechanisms,

and custom-built dynamic web pages embedded into the learning management system for the delivery of the Resourcefulness training. No learner constraints such as literacy or prerequisite abilities were anticipated. Any accommodation needs for a variety of disabilities were handled through established university procedures and facilitated by university services and the course instructors.

Instructional Differences and Pedagogical Considerations. The guiding factors in the design of the treatment condition consisted of creating an instructional sequence that complemented existing practices and encouraged a concurrent increase in lifelong learning skills for the long term and improving student achievement in computer programming skills in the short term. A key constraint in managing the design of this instruction was to achieve an appropriate "return on investment" where the impact in the investment of student time was minimized between the control and treatment groups. At the same time, if the method of instruction could achieve progress in multiple outcome areas concurrently, overall "return" or quality of the learning experience would be demonstrated. As discussed above, much of the design for this instruction was based on the recommendations found in the research literature.

Design Phase

Dunlap and Grabinger (2003) advocated for a handful of instructional features that facilitate the development of lifelong learning characteristics. These lifelong learning characteristics included capacity for self-direction, capacity for metacognitive awareness, and disposition toward lifelong learning. The authors created a comparison table identifying which of five instructional features (autonomy, intrinsic motivation, enculturation, discourse and collaboration, and reflection) addressed specific elements of

three lifelong learning characteristics. The authors then explained how three teaching methodologies (problem-based learning, intentional learning environments, and cognitive apprenticeships) address all of the five instructional features in different ways.

While the meta-analysis was effective in linking teaching strategies for lifelong learning characteristics, it was from a hypothetical perspective. Few if any of the cited works include empirical testing or comparisons to validate claims of effectiveness against other instructional methods. Additionally, the categorization of lifelong learning characteristics did not map to the same levels or factors of abstraction (see Figure 1) as existing measurement instruments for lifelong, self-directed, or autonomous learning (see Table 6 below). Specifically, some of Dunlap & Grabinger's (2003) characteristics align with the factor level of the Learner Autonomy Profile such as "Identify, find, use, and critique resources" (p. 7) roughly mapping to the Resourcefulness factor while others align with the subscale level such as "Set specific goals and objectives for learning" (p. 10) mapping to the Planning, Future Orientation, and Deferring Gratification subscales of the Resourcefulness factor.

Table 6

Dunlap and Grabinger's Lifelong Learning Characteristics Mapped to Measurement Instruments

Lifelong Learning Characteristics *Dunlap & Grabinger, 2003*	**Mapped Element(s)**	**Measurement Instrument**
Capacity for Self-Direction	Initiative, Persistence Volition Self-regulation Goal maintenance	LAP
Identify and define a problem or learning need	Circumstance Change skills	LAP-Desire
Establish goals and objectives for addressing the problem or learning need	Planning Goal directedness	LAP-Resourcefulness LAP-Initiative
Develop action plans and timelines to guide learning activities	Planning	LAP-Resourcefulness
Identify, find, use, and critique resources for solving the problem or meeting the learning requirement	Scholarly activities Technical skills in information seeking Critical curiosity LAP-Resourcefulness	JSPLL ELLI LAP
Capture and apply information from resources to the problem or learning need	Scholarly activities Technical skills in information seeking Critical curiosity LAP-Resourcefulness	JSPLL ELLI LAP
Critique information, skills, and processes used to solve problems or meet learning requirements	Self-regulation Scholarly activities Technical skills in information seeking	LAP-Persistence JSPLL
Capacity for Metacognitive Awareness	Strategic awareness	ELLI
Take conscious control of learning	Goal directedness Planning	LAP-Initiative LAP-Resourcefulness
Plan and select learning strategies	Planning Evaluate alternatives	LAP-Resourcefulness
Monitor and evaluate effectiveness of learning strategies through self-assessment and review	Self-regulation Goal maintenance	LAP-Persistence

Adjust learning behaviors, processes, and strategies	Self-regulation Goal maintenance	LAP-Persistence
Reflect on learning	Goal maintenance	LAP-Persistence
Disposition Toward Lifelong Learning	Change & Learning	ELLI
Risk taking	Anticipating consequences	LAP-Resourcefulness
Intellectual curiosity	Critical Curiosity	ELLI
Planning and making decisions	Planning Evaluate alternatives	LAP-Resourcefulness
Seeking deep understanding	Critical Curiosity	ELLI
Viewing learning as an ongoing process	Future orientation	LAP-Resourcefulness
Intrinsic motivation	Initiative	LAP
Persistence	Persistence	LAP

Of the five instructional features described by Dunlap and Grabinger (2003), reflection and providing student autonomy, responsibility, and intentionality addresses the highest percentage of the LAP Learner Resourcefulness subscales. When examined from the perspective of the LAP-SF instrument, all of the four LAP factors are addressed by the reflection instructional feature. Autonomy is the only other feature that seems to have a wide reach across lifelong learning characteristics. However, as this is the overarching construct of the Learner Autonomy Profile instrument, autonomy represents the target outcome. In other words, autonomy appears to be the end rather than the means to the end. Snow, Corno, and Jackson (1996) would describe this as both the end and means to the end along the commitment pathway, which acknowledges that each learner comes to the course with some degree of experience with autonomy. The question in this case is how to clarify and amplify the learner's capacity to take increased control over their learning habits and patterns. Two of Dunlap and Grabinger's lifelong learning characteristics explicitly include resources from the external perspective while seven others map to the subscales of Learner Resourcefulness. The intentional control elements

of planning, evaluating alternatives, and anticipating consequences are most clearly mapped, future orientation is also addressed, while learning priority, deferring gratification and resolving conflict are addressed, but are not described as similar of terms as the others.

Dunlap and Grabinger (2003) analyzed three teaching methodologies that exhibit the instructional features for developing lifelong learning: problem-based learning, intentional learning environments, and cognitive apprenticeship. The authors describe how these methods exhibit all five of the instructional features that they feel lead to lifelong learning skills. Dunlap (2005) conducted a preliminary study on a convenience sample of twenty-six students in a C++ programming course using a problem-based learning methodology. The data collected during the study came directly from student journals. Observations and conclusions in the study were drawn from qualitative interpretations of statements made in the journals. The findings were encouraging in describing gains and improvements in lifelong learning skills. However, Dunlap identified the non-comparative nature of the study as a limitation to generalization of the findings.

A comparison of Dunlap and Grabinger's (date) recommendations for increasing lifelong learning characteristics with the subscales measured in the Learner Autonomy Profile instrument indicates a strong alignment between the two. These recommendations include instructional activities and processes, such as "create plans for achieving their goals and objectives" and "ask both knowledge and wonderment questions to focus learning on goals and objectives" (p. 10). Their recommendations also highlight the role of a personal gap analysis to identify what the learner knows and doesn't know about a

topic and to aid and encourage the learner in identifying resources that they may use as part of their study and learning. The personal gap analysis also appears in the recommendations for encouraging reflection (adapted from Blakely and Spence, 1990) which include: ask the students to consciously identify what they know as opposed to what they don't know, use journals or logs to help students reflect upon their learning processes, engage students in guided self-evaluation through individual conferences and checklists to help them focus on their thinking processes, and involve students in think-alouds, role-plays, and structured walkthrough activities that encourage them to describe their thinking, learning, and decision-making processes. These recommendations were adapted to an online learning format and incorporated into the instructional materials and activities of the treatment condition.

Development Phase

The existing online version of the course was primarily delivered through a learning management system that provided instructional written and multimedia content, hyperlinks to external learning resources, digital assignment submission, grading, and assessment features. In order to minimize disruption and novelty effects, the instructional treatment was built to follow similar styling and workflow attributes of the existing course. Thus, a number of content objects were created and stored on a separate server and embedded into the learning management system interface as external resources similar to the external resources and embedded content elements of the existing course.

In order to provide autonomy, responsibility, and intentionality instructional features in conjunction with reflection features, dynamic web pages were created for data collection and research purposes (see Appendix O for flowchart). These pages were

database driven and provided the ability for capturing learner responses and displaying their responses back again at subsequent points of the instruction. Thus, the learner retained a sense of responsibility to self for how they were implementing patterns of Learner Resourcefulness as the course proceeded.

From the learner's perspective, the course followed routines similar to those from the first half of the course: presentation of content, practice assignments, and assessments. The only change was the addition of one new content package in each lesson folder that presented Learner Resourcefulness characteristics, goals that target enhanced practice of the learning patterns, and reflection and reporting on implementation of the skill. The learner was first presented with a short video introducing the concept of Learner Resourcefulness followed immediately by a personal inventory sheet where the learner assessed the level or degree to which they make use of Resourcefulness habits and practices.

The instructional treatment began with a direct instruction approach using a video to illustrate and explain the subscales and characteristics of Learner Resourcefulness. The video used a short three- to four-minute clip from the television show MacGyver to provide an illustration of the concepts while callouts were overlaid at the bottom of the screen to describe each element. The audio was minimized so that a narrator could provide further explanation and questions to prompt the learner to think about how and when they could implement similar patterns during study efforts.

The learner was then presented with a short seven item inventory where they evaluated the frequency of their personal implementation of Resourcefulness habits. The responses of each learner were stored in a database so they could be presented to the

learner again at a later date for further reflection purposes. A key or legend was provided to aid the learner in the self-evaluation process and to improve data quality for analysis purposes.

The learner then entered a cycle that was repeated once per week where they were presented with their goal from the previous week and asked to write a short (2-3 sentence) explanation of how they did during the week in relation to their goal. This provided a moment of reflection to allow the learner to determine the validity of their responses in light of their goals and actions from the prior week. The reflections were captured to create a compiled journal of thoughts and progress for each individual learner. The learner was then presented with a video dramatization of a selected Learner Resourcefulness attribute in the form of a short (one to five minute) multimedia clip. The learner could then select a personal goal for the coming week from a series of suggested goals or create their own goal in order to provide for autonomy in the learning process.

Implementation Phase

Two separate pilot studies were implemented to prepare for the full study. The first implemented a scaled down version of the LAP-SF (21 items rather than 66) in order to address concerns over the possibility of multicollinearity in the analysis of the study results. Each learner enrolled in the programming course were asked to complete the survey on a voluntary basis so there was a potential for self-selection bias in the data. However, the purpose was to gain a preliminary indication as to which statistical analysis methods would be appropriate for the later full study. Findings from this pilot study are discussed in the Data Analysis section of chapter III below.

The second pilot study was conducted in order to ensure that the training materials were fully functional. Also, timing data was gathered in order to minimize the difference in load for students in both the control and treatment groups. The hope was to lessen any potential for negative responses amongst those in the treatment group who were called upon to have an additional workload from the course. This second pilot study consisted of twenty-one participants who completed the functionality testing over a period of two weeks.

The implementation phase started with a course pretest that occurred at the beginning of the semester. The pretest was drawn from existing lesson and unit level questions that had been developed used at various times for the course previously. Pretesting practices have been used for the target course by some instructors and other courses within the department have made sporadic use of this technique as well. The remainder of the study occurred over a six week time period for all groups during the second half of the semester. All instructional materials were delivered on a weekly basis as planned. In addition, the LAP-SF survey was presented to the appropriate pretest groups (Groups A and B) immediately prior to the six week treatment period and to all study participants at the end of the period. The survey was operated by the HRDE system so data generated from the first stage of the study could not be obtained or reviewed until after the entire study was completed.

Evaluation Phase

The effectiveness of the instructional treatment will be measured by evaluating the results of all pre- and posttests and related course assignments. Comparing results across all groups will help clarify which treatment methods are most widely beneficial.

Instrumentation

Carr (1999) and later Confessore and Park (2004) defined, standardized, and then streamlined measurements of Learner Resourcefulness into the following seven subscales: learning priority, deferring gratification, resolving conflict, future orientation, planning, evaluating alternatives, and anticipating consequences. Carr's original Inventory of Learner Resourcefulness (ILR) consisted of a survey of eighty items that were self-assessed by the respondent on a ten point scale and scored at the one quarter of a point level (e.g. 0.00, 0.25, 0.50, etc.). The ILR was used in conjunction with the Inventory of Learner Desire (ILD), Inventory of Learner Initiative (ILI), and Inventory of Learner Persistence to create a 164-item complete form and later a 66-item short form of the Learner Autonomy Profile (LAP) instrument (see Confessore & Park, 2004).

Collaborative efforts, extensive experience, numerous development and improvement efforts have been invested into the creation, validation, and simplification of the Learner Autonomy Profile as a measurement instrument (see Carr, 1999; Derrick, 2001; Ponton, 1999; Confessore & Park, 2004). Further studies have used the instrument to examine relationships with a variety of educational outcomes, theories, and constructs (Derrick, Rovai, Ponton, Confessore, & Carr, 2007; Park, Christmas, Schmaltz, & Durso, 2006; Lowe, 2009; Ng, Confessore, Yusoff, Abdul Aziz, & Lajis, 2011; Buvoltz, Powell, Solan, & Longbotham, 2008; Ng & Confessore, 2010; Sanders, 2006; Derrick, Ponton, & Carr, 2005; Carlson, Wyatt, & Davis, 2003). These studies have shown strong performance in generating significant results and elucidating the role of autonomy characteristics in learning. However, this study will seek to clarify how to integrate the

development of these important characteristics into instruction at a higher education level.

The Learner Autonomy Profile (LAP) has been used in both academic and commercial settings. The short form was available online on the Human Resource Development Enterprises web site (2000). Upon completion of the form, the learner's responses are factored against the database of all other responses and reported back to the learner in terms of a score that shows their individual ranking against all other responses on each of the four conative factors of autonomy and twenty-two subscales. The reported score was standardized on a nine point scale known as a stanine. Human Resource Development Enterprises encourages each learner to work with a Certified Learner Autonomy Coach (CLAC) to interpret the report and to plan ways to help strengthen personal learning autonomy.

Instructional Materials

As the treatment was applied to both face-to-face and online sections of the course, the instructional materials were designed to be consistent and accessible across both instructional formats. Course designers and instructors were both concerned about the amount of time and energy that might be required by the students to engage with the Resourcefulness materials. Instructors expressed concern that gaining and keeping learner attention was often challenging enough in both the face-to-face and online formats of the course. These constraints are fairly common as evidenced by the numerous surveys and studies on student engagement (see Quaye & Harper, 2014 for a review). Short (one to five minute) movie clips were selected to introduce the learner to the Learner Resourcefulness concepts that can be rather abstract upon first introduction to the ideas.

The multimedia materials were selected based on informal surveys where respondents were presented with short descriptions and examples of each subscale of Resourcefulness and then asked what movies or media they were familiar with that illustrated those concepts. The researcher then previewed and selected appropriate portions that could provide tangible examples of the abstract concepts.

Following the recommendations of Dunlap and Grabinger, the instructional materials on developing Learner Resourcefulness were designed to provide features of autonomy and reflection. As shown in the screenshots of the course in Figures 2 and 3 below, the learner was presented with a video to illustrate a concept in a short period of time. The learner was also presented with prewritten goals written in the first person that they could select from a list or an "Other" box where they could articulate their own personal goal for the week. The purpose in the design was to increase awareness and consciousness of Resourcefulness habits that the learner may or may not be implementing as they studied during each week of the intervention period. In addition to awareness, selecting a goal provided an area of specific focus that became exercises for the learner's will.

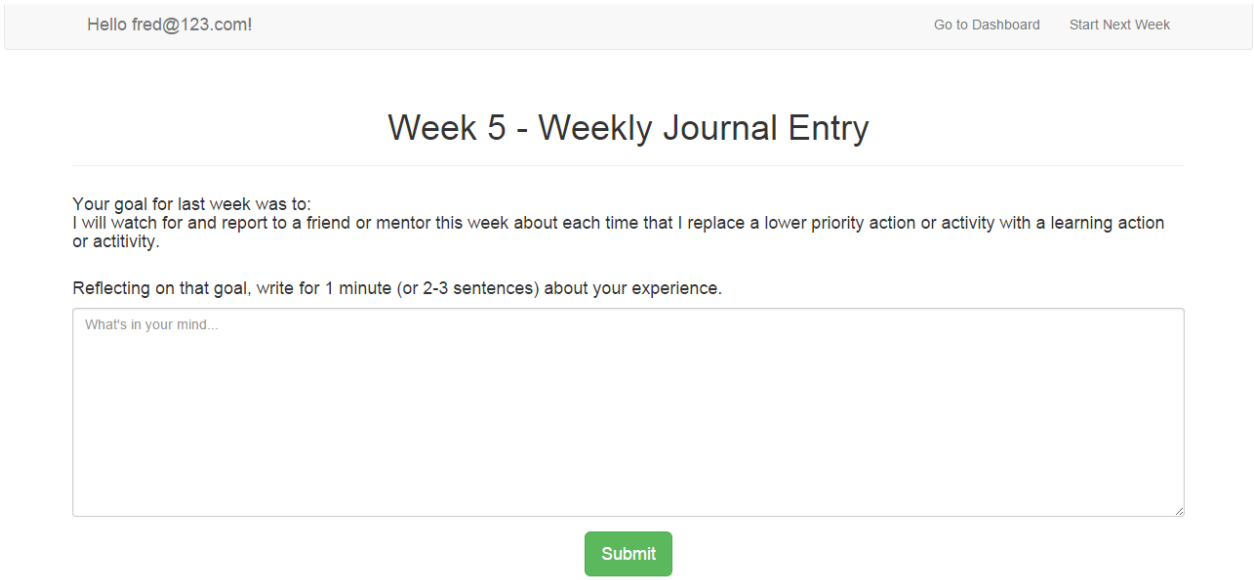

Figure 2. Reflection Page. This figure shows the user interface displayed to the participants as they reported on goals made in the prior week.

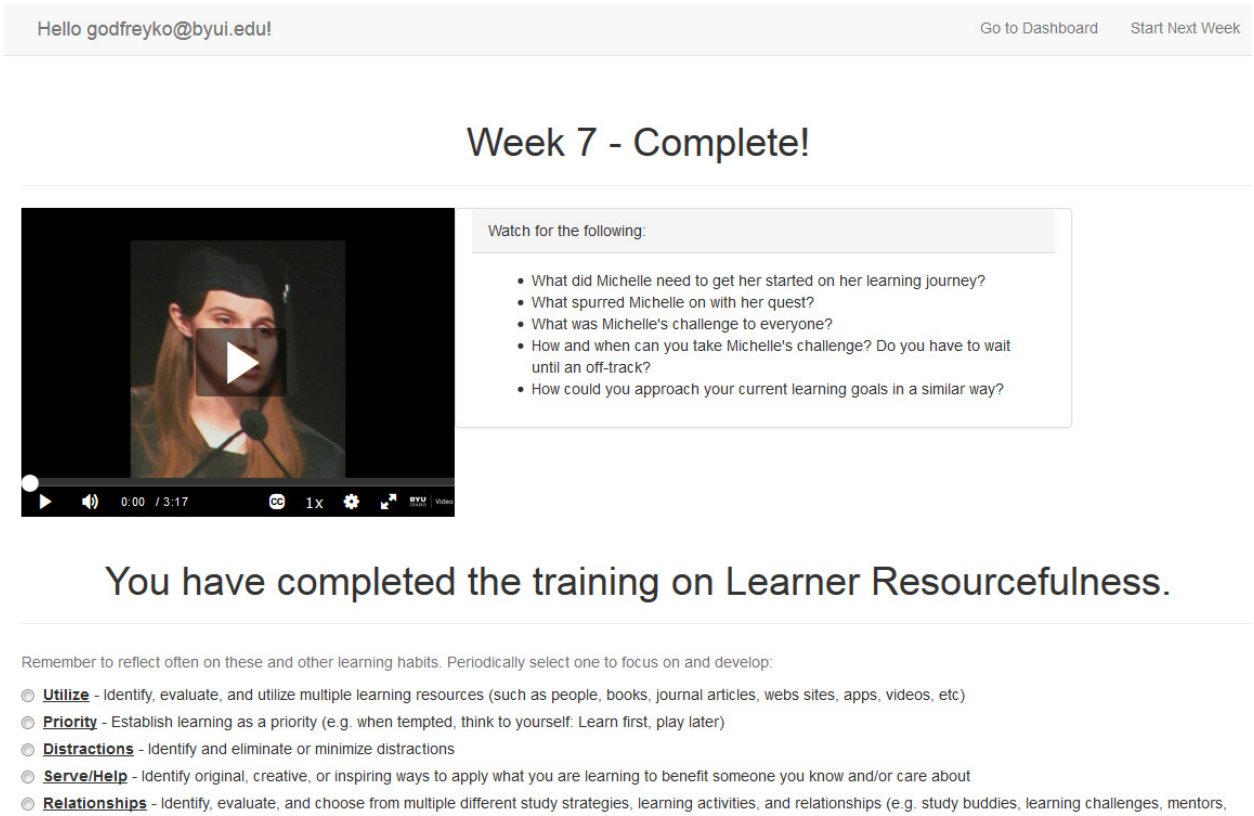

Figure 3. Video Training Page. This figure shows the user interface displayed to the participants as they watched the multimedia video and then set a Resourcefulness goal for the week.

At the beginning of the subsequent week, the learner was presented with a reflection page where they were presented with the goal they set in the previous week and invited to think back on and write for one minute or two to three sentences about how they did with exercising their goal during the previous week. This was the reflection feature which, according to Dunlap and Grabinger (2003), should positively influence the widest range of lifelong learning skills. Wheatley (1992) explained that, without reflective activities, students often become so involved in completing a task that the learning process is hindered; students are unable to put all the pieces back together again to comprehend the complete whole of what has been learned or how the learner has changed.

The flow chart in Figure 4 below depicts the instructional sequence for the Resourcefulness materials. The learner was first presented with the Learner Autonomy Profile – Short Form (LAP-SF) as a pretest event. The data from this profile was collected by the Human Resource Development Enterprises website and stored in a database created for the study and shared with the researcher. Next, the learner was presented with an introduction video to explain and illustrate the various elements and subscales of Learner Resourcefulness. The learner was then presented with a simplified inventory on Resourcefulness designed to help the learner self-assess their ability and frequency of applying Resourcefulness habits in their learning. As part of the inventory process, the learner was then invited to set a specific goals to focus on a Resourcefulness habit for the coming week and shown a confirmation page showing their goal for the week and their Resourcefulness inventory results. The reporting, media illustrations, and goal setting pattern repeated for six weeks until the end of the learning period. After the

final training period was over, the learner was again asked to complete the LAP-SF form as a posttest.

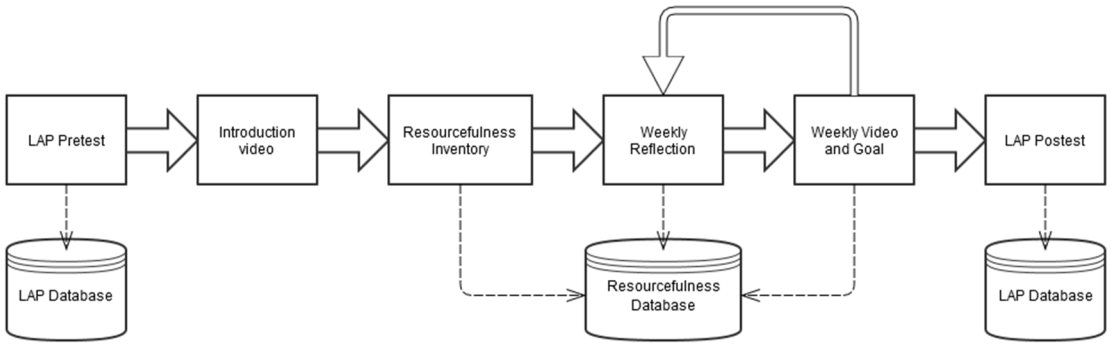

Figure 4. Flowchart of Learner Resourcefulness Training Materials. This figure depicts the activity flow and data collection of the Resourcefulness training elements.

Data Collection

A subset of the Inventory of Learner Resourcefulness (ILR) was administered to a set of 22 students in the introductory computer programming course during a semester prior to the study. Also test data on student achievement was collected for the targeted instructional units of the course. This early collection was performed as a pilot study in order to gather a preliminary sense of the level of correlation between variables and to identify the appropriateness of the research design, data collection, and analysis processes that would be necessary for the full study.

In the full study, participants completed the Learner Autonomy Profile – Short Form (LAP-SF) through the Human Resource Development Enterprises (HRDE) online system before (Groups A and B) and after (all groups) the applicable instructional treatment. Each student received a personalized report on each of the four factors and twenty-two subscales of the profile via e-mail from the HRDE system. The HRDE system provides a composite total score representing Learner Autonomy that was used to

address research question three. The system also reports individual scores for each of the four factors (Desire, Initiative, Resourcefulness, and Persistence). The Resourcefulness scores were used to answer research question one. This data was collected in two distinct sets through the HRDE online system and delivered to the researcher in a tabulated data format for the data analysis phase.

Student achievement data was collected via standard assessment processes conducted through an online learning management system. This system was in place for several years prior to the study and required no special training for instructors administering the assessments or the students who will take the assessments since it was used previously through the course and throughout the university as a whole. All students in these sections completed a pretest and posttest addressing the course content and skills in a controlled access online environment.

The fourth research question was addressed through a series of focus groups and interviews that were conducted to capture representative perspectives of the participants involved in the study. Following the flexible and adaptive guidelines from Vaughn, Schumm, and Sinagub (1996), one set of candidates was selected at random from a stratified grouping of students by treatment condition and by performance level. High performing students were defined as those with a B- or higher grade in the course and low performing students were defined as those with a C+ or lower. Treatment groups were split up by high and low performance levels. Six focus group events were held in all. The size of the groups was targeted to be between four and eight participants, as recommended by Kitzinger (2005). Follow up interviews were conducted by selecting participants at random from each group depending on the level of participation and

cohesiveness of responses both within and across groups. A prepared introduction and sample questions are provided in Appendix P.

Data Analysis Method

Braver and Braver (1988) outline a method of data analysis for Solomon Four Group Design studies. This method begins with a two-by-two factorial Analysis of Variance (ANOVA) examining both the main effects of the treatment and the pretest along with the interaction effects of the treatment and pretest. The analysis pathway then continues with a series of follow up tests including main effects tests, Analysis of Covariance, t tests, etc. that depend on the results of the previous tests. Their procedure and the decision points along the way are summarized in the flowchart in Figure 5 below.

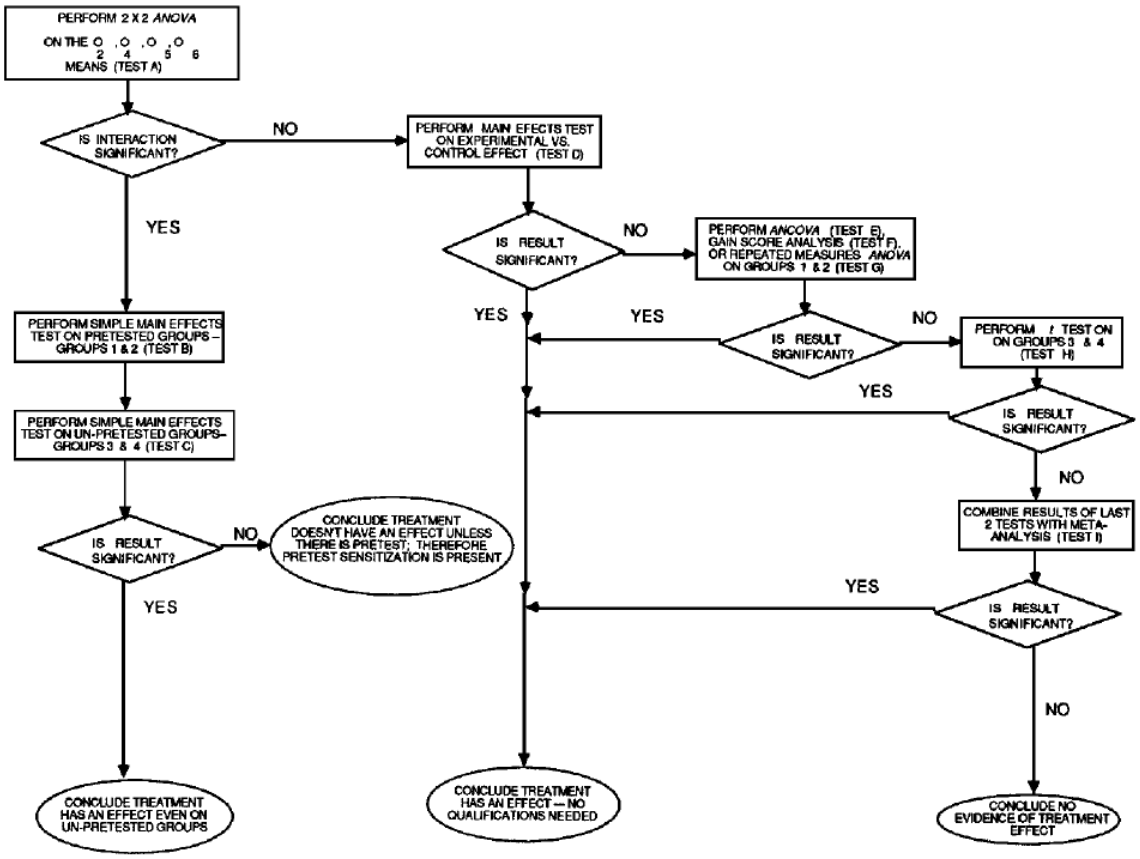

Figure 5. Braver and Braver (1988) Solomon Design Analysis Method Flowchart. This figure depicts the decision flow recommended by Braver and Braver.

Sawilowsky and Markman (1988) challenged these procedures to which Braver and Braver responded. Sawilowsky, Kelley, Blair, and Markman (1994) later provided clarifications regarding this approach which included recommendations that the tests not be conducted in a prescribed decision flow due to the increased probability of Type I error. Thus the results of Univariate ANOVA with a full factorial model were used along with ANCOVA and t-tests to address each of the first three quantitative research questions. Sawilowsky et al. (1994) ran numerous power curve simulations to determine which tests had the greatest power over various degrees of treatment magnitude. Their

conclusion is that the statistical power for each type of test varied depending on other variables such as the treatment magnitude and the correlation of pretest and posttest. Sawilowsky et al. (1994) point out that further study is needed to resolve potential questions and issues with the use of Stouffer's Z and identify the test of the weighted mean effect size (Hedges & Olkin, 1985) or Cohen's *d* (1988) as potential solutions. Thus the present study will conduct the recommended statistical tests recommended by Braver and Braver including ANOVA, full factorial ANOVA, ANCOVA, and t tests without regard to the sequence as suggested by Sawilowsky et al. (1994). Furthermore, Cohen's d will be included for additional explanatory detail.

Qualitative data analysis will consist of classifying and interpreting focus group and interview responses. These results will be cross-checked against the outcome of the quantitative elements of the study in research questions one through three. This qualitative approach is intended to help clarify and provide additional detail from the perspectives of the participants directly.

CHAPTER IV

Results

The purpose of this study was to examine the effect on both learner autonomy (specifically the *Resourcefulness* of the learner) and computer programming achievement when a course originally designed for traditional computer programming achievement outcomes was redesigned to address lifelong learning skills concurrently. The study examined the effects of an instructional design intervention on both computer programming performance and learner autonomy skills simultaneously by exploring the following research questions:

1. As measured by pretests and/or posttests of Learner Resourcefulness, is there a significant difference in Learner Resourcefulness between students who receive traditional computer programming instruction and students who receive an instructional intervention that integrates Learner Resourcefulness training with computer programming instruction?
2. As measured by pretests and/or posttests of student achievement in computer programming, is there a significant difference in performance between students who receive traditional computer programming instruction and students who receive an instructional intervention that integrates Learner Resourcefulness training with computer programming instruction?
3. As measured by pretests and posttests, is there an interaction effect between the development of learner autonomy and computer programming achievement when each is pursued in conjunction with the other?

4. How do student perceptions of the concurrent training compare to the results shown in the collected data?

Description of the Sample

Several prior studies have examined demographic data in connection with the Learner Autonomy Profile. Commonly reported attributes include gender, marital status, class rank, ethnicity, and education level. Each of these study demographics are reported in the succeeding paragraphs and related data tables. This data was collected from official university records.

The study participants reflected the expectations from prior semesters where the predominant demographics were single, white, male, of traditional age, freshman class rank, with a high school education (see Tables 7–9). This demographic profile deviates slightly from the larger campus demographics in that the course traditionally has a higher proportion of males, a lower proportion of married students, and a lower proportion of upper classmen than the student body at large. However, these results appear consistent with other computer related courses at the target institution. Finally, ethnicity was primarily white. While this attribute varies in other studies, no correlations have been found relating it to the learner autonomy profile factors (see Buvoltz, Powell, Solan, & Longbotham, 2008; Sidhu & bin Embi, 2009; Kaur & Sidhu, 2010; Wighting, Liu, & Rovai, 2008; Yen & Liu, 2009).

Table 7

Marital Status of Study Participants

Status	Count	Percent
Single	85	70.8%
Married	35	29.2%
Total	120	100%

Table 8

Ethnicity of Study Participants

Ethnicity	Count	Percent
Asian/Asian American	4	3.3%
Black/African American	7	5.8%
Hawaiian/Pacific Islander	1	0.8%
Hispanic	6	5.0%
White	98	81.7%
Two or more	3	2.5%
Unknown	1	0.8%
Total	120	100%

Table 9

Gender of Study Participants

Gender	Count	Percent
Female	29	24.2%
Male	91	75.8%
Total	120	100%

Two other factors that threaten the generalizability of study findings include the religious affiliation and mission status of study participants. All of the study participants are affiliated with the sponsoring religion, according to official university records. The sponsoring religion encourages a variety of service oriented activities including mission service. Of the study participants, 69 or 57.5% had completed a service mission (see Table 10).

Table 10

Religious Mission Status of Study Participants

Religious Mission	Count	Percent
True	69	57.5%
False	51	42.5%
Total	120	100%

Of the 120 participants in the study, 30 were randomly assigned into groups as described in chapter III. The groups each received treatment and pretest conditions according to the research design. Using the Solomon design allows for double that number (60 total) to be included in each group when answering questions about the treatment versus no treatment or pretest versus no pretest conditions. Participation in the study was voluntary and completion of the study components was not required or awarded points in the class in order to reflect the autonomous nature of the study design. Completion of the study components are shown in Table 11 below. Group A was the only group of the four which participated in both the LAP survey as both pretest and posttest along with the treatment elements of the study. It began with 30 randomly assigned participants, but ended with only seven completing the course programming pretest, both LAP surveys as a pretest and posttest, the Treatment, and the programming achievement posttest. Group D, which participated in neither the LAP pretest nor the Treatment, also began with 30 randomly assigned participants. A total of 19 of those completed the LAP posttest and thus completed all of their assigned elements of the study. The loss of participants from each group affected analysis of the research questions in various ways; mitigation of that loss is discussed both in Chapter IV as the findings of each research question are presented, and in Chapter V in the implications for future research. The

general trend in this data seems to follow a pattern where as the amount of additional learning activities increased, there was a corresponding decrease in completion of the study components that were completed by participants in those groups.

Table 11

Completion of Study Components

Treatment	*Participants*	*Completed LAP Pretest*	*Completed Treatment*	*Partial Treatment*	*Completed LAP Posttest*	*Complete Data Sets*
A	30	24	13	11	10	7
B	30	23	N/A	N/A	22	17
C	30	N/A	17	9	16	12
D	30	N/A	N/A	N/A	19	19
Total	120	47	30	20	67	55

Research Question One

The first research question for this study was:

> As measured by pretests and/or posttests of Learner Resourcefulness, is there a significant difference in Learner Resourcefulness between students who receive traditional computer programming instruction and students who receive an instructional intervention that integrates Learner Resourcefulness training with computer programming instruction?

The research question can be restated as a null hypothesis as follows:

> H_0: As measured by pretests and/or posttests of Learner Resourcefulness, there is no difference in Learner Resourcefulness between students who receive traditional computer programming instruction and students who receive an instructional intervention that integrates Learner Resourcefulness training with computer programming instruction.

Research Question One was addressed by analysis of variance (ANOVA) with the posttest Learner Resourcefulness subscale results from the Learner Autonomy Profile as the dependent variable. Subscale results are calculated as raw scores by the HRDE system and then compared against the raw scores of all other respondents and

standardized into a stanine (scale of 1 to 9) score that is reported to the participants. Since the raw scores and stanine scores are used by researchers and practitioners for different purposes, both the raw scores and stanine scores were used in this analysis to show richer detail. The groupings of the ANOVA test followed the Solomon Four Group Design and this method is described as Test A by Braver and Braver (1988). There were 67 total participants who completed the Learner Autonomy Profile as a posttest that could be used for this analysis (see Table 12).

The instructional intervention was intentionally kept to a minimum amount of time and attention in order to minimize the effect of splitting student focus away from the targeted course material. Hattie (2003) places average effect size for educational influences at approximately 0.4, which Cohen would classify as a small effect. There is still very little empirical research to build upon in identifying a standard for how much of an influence to expect in any direction when designing instructional interventions that integrate lifelong learning and student achievement concurrently. In addition, the risk of a type II error where a difference is not found when there is in reality a difference seems to be a greater concern than the risk of type I error a difference is claimed when in reality there is no difference in this early phase of research on integrated outcomes. Thus, alpha level was set at .10 in order to increase the likelihood of capturing a difference of what is expected to be small effect sizes.

Table 12

Results for ANOVA on Research Question One – Resourcefulness Raw Scores

Dependent Variable: Resourcefulness_Posttest_Raw

Treatment	LAP_Pretest	Mean	Std. Deviation	N
No	No	134.3289	16.86755	19
	Yes	150.9091	18.59796	22
	Total	143.2256	19.48556	41
Yes	No	139.2031	31.37332	16
	Yes	134.7250	27.28742	10
	Total	137.4808	29.38647	26
Total	No	136.5571	24.30921	35
	Yes	145.8516	22.55154	32
	Total	140.9963	23.77345	67

The results of the ANOVA tests of between-subjects effects using IBM SPSS software are shown in Tables 13-15 below. The Treatment main effect result on the raw scores was $p = .461$ and the LAP Pretest main effect was $p = .143$. Both indicate no significant difference in raw scores between groups was found for the main effects of Treatment and LAP Pretest. However, a significant difference in stanine scores was found at the $p < .10$ level for the main effect of LAP Pretest ($p = .083$), while stanine scores indicated no significant difference between groups for the main effect of Treatment ($p = .621$).

Table 13

Results for ANOVA on Research Question One - Resourcefulness Stanine Scores

Dependent Variable: Resourcefulness_Posttest_Stanine

Treatment	LAP_Pretest	Mean	Std. Deviation	N
No	No	3.53	1.712	19
	Yes	5.45	2.176	22
	Total	4.56	2.180	41
Yes	No	4.31	2.651	16
	Yes	3.80	2.658	10
	Total	4.12	2.613	26
Total	No	3.89	2.193	35
	Yes	4.94	2.422	32
	Total	4.39	2.348	67

The LAP Pretest effect sizes on the Resourcefulness raw scores were d = .40 and d = .46 for Resourcefulness stanine scores. These results were interpreted as a small effect in a positive direction, meaning that when the groups that received the LAP survey as a pretest (Groups A and B) were compared against those that did not receive the LAP survey as a pretest (Groups C and D) the overall mean resourcefulness scores were higher for the pretest groups. Treatment effect sizes on the Resourcefulness raw scores were d = -0.24 and d = -0.19 for Resourcefulness stanine scores. These results were interpreted as a small negative effect, meaning that when the groups that the groups that received the treatment (Groups A and C) were compared with the groups that did not receive the treatment (Groups B and D) the overall mean resourcefulness scores were lower for the Treatment groups than for the no Treatment groups. While the Treatment effect was not statistically significant in this case, it is reported here to help frame expectations for further research which may need to use a larger sample size in order to establish the statistical significance of the smaller effect size.

Table 14

Results for ANOVA on Research Question One - Resourcefulness Raw Scores

Dependent Variable: Resourcefulness_Posttest_Raw

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1749.410[a]	2	874.705	1.575	.215
Intercept	1252212.332	1	1252212.332	2254.190	.000
Treatment	305.342	1	305.342	.550	.461
LAP_Pretest	1224.314	1	1224.314	2.204	.143
Error	35552.277	64	555.504		
Total	1369258.188	67			
Corrected Total	37301.687	66			

a. R Squared = .047 (Adjusted R Squared = .017)

Table 15

Tests of Between-Subjects Effects for Research Question One on Stanine Resourcefulness Scores

Dependent Variable: Resourcefulness_Posttest_Stanine

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	19.821[a]	2	9.910	1.843	.167
Intercept	1212.463	1	1212.463	225.516	.000
Treatment	1.328	1	1.328	.247	.621
LAP_Pretest	16.662	1	16.662	3.099	.083
Error	344.090	64	5.376		
Total	1654.000	67			
Corrected Total	363.910	66			

a. R Squared = .054 (Adjusted R Squared = .025)

Interaction Effects on Resourcefulness

The ANOVA tests with raw Resourcefulness subscale scores and stanine Resourcefulness subscale scores included 67 participants with the descriptive statistics shown previously in Table 16. The interaction effect was measured at probability (p) of .08 when conducted on raw scores for the Resourcefulness subscale. This was significant at the $p > .10$ level. When conducted on the stanine scores of the Resourcefulness

subscale, the interaction effect was measured at $p = .038$, which is significant at the .05 level. (see Table 17).

Table 16

ANOVA Results for Research Question One on Raw Resourcefulness Scores

Dependent Variable: Resourcefulness_Posttest_Raw

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3451.153[a]	3	1150.384	2.141	.104
Intercept	1199859.735	1	1199859.735	2233.086	.000
Treatment	490.871	1	490.871	.914	.343
LAP_Pretest	562.036	1	562.036	1.046	.310
Treatment * LAP_Pretest	1701.743	1	1701.743	3.167	.080
Error	33850.533	63	537.310		
Total	1369258.188	67			
Corrected Total	37301.687	66			

a. R Squared = .093 (Adjusted R Squared = .049)

Table 17

ANOVA Results for Research Question One on Stanine Resourcefulness Scores

Dependent Variable: Resourcefulness_Posttest_Stanine

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	42.682[a]	3	14.227	2.790	.048
Intercept	1121.253	1	1121.253	219.902	.000
Treatment	2.894	1	2.894	.568	.454
LAP_Pretest	7.691	1	7.691	1.508	.224
Treatment * LAP_Pretest	22.861	1	22.861	4.483	.038
Error	321.229	63	5.099		
Total	1654.000	67			
Corrected Total	363.910	66			

a. R Squared = .117 (Adjusted R Squared = .075)

Additional Validation Tests on Research Question One

Based on the ANOVA results given above, Braver and Braver (1988) call for Test B, an analysis of main effects on the pretested groups (Groups A and B), and Test C, an

analysis of main effects on the un-pretested groups (Groups C and D). Test B result when using the raw scores were $t(30) = -1.967$, $p = .059$ and $t(30) = -1.861$, $p = .073$ when using stanine scores which were both significant at the $p < .10$ level. Test C yields no significant results with $t(33) = .085$, $p = .562$ using raw scores and $t(33) = 1.058$, $p = .298$ using stanine scores.

ANCOVA tests with course achievement pretest scores as a covariate with both raw scores and stanine scores of the Resourcefulness subscale were conducted for thoroughness and to avoid the Type I error rate results identified by Sawilowsky et al. (1994). No significant results were found when the pretest covariate was included. Full results of these tests are shown in Appendix Q. When using stanine scores the LAP pretest main effect of $p = .088$ was significant at the .10 level (see Appendix R). All other covariate, main, and interaction effects were found to be non-significant.

Research Question One Summary

Research Question One asked whether different instructional intervention conditions had an effect on Learner Resourcefulness as measured by the Learner Autonomy Profile. The results indicated a non-significant result using raw scores and a significant pretest effect at the $p < .10$ level using stanine scores. The statistical analysis also indicated a significant interaction effect between the treatment and pretest effects at the $p < .10$ level using raw scores and a significant interaction effect at the $p < .05$ level when using stanine scores. The mixed results of these tests provide sufficient evidence to reject the null hypothesis and conclude that there is a difference in Learner Resourcefulness between students who receive traditional computer programming

instruction and students who receive an instructional intervention that integrates Learner Resourcefulness training with computer programming instruction.

Research Question Two

The second research question for this study was:

> As measured by pretests and/or posttests of student achievement, is there a significant difference in Learner Resourcefulness between students who receive traditional computer programming instruction and students who receive an instructional intervention that integrates Learner Resourcefulness training with computer programming instruction?

The research question can be restated as a null hypothesis as follows:

> H_0: As measured by pretests and/or posttests of student achievement, there is no difference in student achievement between students who receive traditional computer programming instruction and students who receive an instructional intervention that integrates Learner Resourcefulness training with computer programming instruction.

Research Question Two was addressed by a series of tests suggested by Braver and Braver (1988), but conducted in a non-dependent manner as recommended by Sawilowsky et al. (1994). The final exam for the course is comprehensive and addresses subject matter from both before and after the treatment period of the study. The final exam is a required and scored assessment and comprises a sizeable portion of the overall grade for the course. Data for this test were available for 108 participants as can be seen in the results in Table 18 below.

Table 18

Results for ANOVA on Research Question Two – Final Exam Scores

Dependent Variable: FinalScore

Treatment	LAP_Pretest	Mean	Std. Deviation	N
No	No	81.56	16.867	27
	Yes	78.97	19.022	29
	Total	80.21	17.899	56
Yes	No	82.16	14.812	25
	Yes	77.67	17.153	27
	Total	79.83	16.074	52
Total	No	81.85	15.760	52
	Yes	78.34	17.992	56
	Total	80.03	16.967	108

Interaction Effects on Final Exam Scores

Testing began by including a full factorial analysis of variance (ANOVA) with final exam scores as the dependent variable and the Treatment and LAP Pretest as fixed factors. With a $p = .773$ the test showed a non-significant result on the interaction. The main effects of Treatment and LAP Pretest were also non-significant ($p = .916$ and $p = .285$ respectively). The full SPSS output is shown in Table 19 below.

Table 19

ANOVA Results for Research Question Two on Final Exam Scores

Dependent Variable: FinalScore

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	359.924[a]	3	119.975	.410	.746
Intercept	690797.403	1	690797.403	2359.917	.000
Treatment	3.246	1	3.246	.011	.916
LAP_Pretest	337.744	1	337.744	1.154	.285
Treatment * LAP_Pretest	24.385	1	24.385	.083	.773
Error	30442.992	104	292.721		
Total	722483.000	108			
Corrected Total	30802.917	107			

a. R Squared = .012 (Adjusted R Squared = -.017)

Main Effects on Final Exam

According to Braver and Braver, additional tests relating to Research Question Two include Test D, an analysis of the main effects on experimental versus control conditions. This was accomplished by an ANOVA test of only the main effects without the interaction effect included in the statistical model. The results of the ANOVA tests of between-subjects effects with Final Exam Score as the dependent variable using IBM SPSS software are shown in Table 20 below. The treatment and pretest both resulted in non-significant effects with p = .907 and .288 respectively. . The treatment effect size on the final score was *d* = -.02. This result was interpreted as an extremely small effect in the negative direction. The LAP Pretest effect size on the final score was *d* = -.21. This result was interpreted as a small effect in a negative direction.

Table 20

Main Effects of Research Question Two for Treatment and Pretest on Final Exam Score

Dependent Variable: FinalScore

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	335.540[a]	2	167.770	.578	.563
Intercept	690780.049	1	690780.049	2380.642	.000
Treatment	3.946	1	3.946	.014	.907
LAP_Pretest	331.494	1	331.494	1.142	.288
Error	30467.377	105	290.165		
Total	722483.000	108			
Corrected Total	30802.917	107			

a. R Squared = .011 (Adjusted R Squared = -.008)

ANCOVA Results on Final Score

Braver and Braver outlined three options including Test E, (an Analysis of Covariance on the pretested groups with pretest scores as a covariate), Test F (an independent samples *t*-test on "gain" scores between pretest and posttest scores), or Test

G (an repeated measures ANOVA). Braver and Braver recommend Test E which Sawilowsky et al. (1994) concur is the best option of these choices. In this case, ANCOVA comparing Group A against Group B with pretest results as a covariate. This analysis included 51 of the participants as shown in the results of Tables 21 and 22.

Table 21

Results for ANCOVA on Final Exam Score with Pretest as Covariate

Dependent Variable: FinalScore

Treatment	Mean	Std. Deviation	N
No	80.11	17.656	27
Yes	76.46	17.857	24
Total	78.39	17.668	51

With $p = .417$, again the result is non-significant. The treatment effect size between Groups A and B was $d = -.21$, which was interpreted as a small effect size. It is important to note that Sawilowsky et al. (1994) point out that when following a flowchart format of successive tests, the experiment-wise error rate continues to grow. Following Test E, the error rate or possibility of a Type I error in their Monte Carlo simulation was at .1194. Thus, these tests are conducted and interpreted for their independent contributions to the overall interpretation rather than in seeking for one test to overshadow the results of any other.

Table 22

ANCOVA Results for Research Question Two on Final Exam Scores with Pretest as Covariate

Dependent Variable: FinalScore

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	480.879[a]	2	240.440	.763	.472
Intercept	115417.745	1	115417.745	366.229	.000
PretestScore	311.347	1	311.347	.988	.325
Treatment	211.491	1	211.491	.671	.417
Error	15127.278	48	315.152		
Total	329020.000	51			
Corrected Total	15608.157	50			

a. R Squared = .031 (Adjusted R Squared = -.010)

Follow up Tests on Final Score

Test B (*t* test comparing Groups A and B) and Test C (t test comparing Groups C and D) with Final Exam Score as the dependent variable. Test H was not conducted as it produces identical results to Test C and is only included in the Braver and Braver flow chart due to the sequential, decision making nature of the flow chart they created. Test I was also included for completeness. Results for Test B of $t(54)$, $p = .790$ and $t(50)$, $p = .892$ for Test C (and Test H) were each considered non-significant (complete results are available in Appendix S and Appendix T respectively). Test I required that the p-values from Tests E and H be converted to a normal deviate (z) value, and then the resulting zs are combined into a single z_{meta}" (Braver & Braver, 1988 p. 152). Results for Test I were $p = .766$ and were considered non-significant (see Appendix U)

Research Question Two Summary

Research Question Two addressed the effects of the different experimental conditions on student achievement. These effects were examined using a series of

ANOVA, ANCOVA, and t-tests as recommended by Braver and Braver (1988) and Sawilowsky et al. (1994) for a Solomon Four Group Design. All tests indicated nonsignificant main effects and interaction effects on student achievement scores. The high p-values that were all well above the alpha level that had been raised to $p < .10$ suggest that that there were no significant positive or negative effects on student achievement.

Research Question Three

The third research question for this study was:

> As measured by pretests and posttests, is there an interaction effect between the development of learner autonomy and computer programming achievement when each is pursued in conjunction with the other?

The research question can be restated as a null hypothesis as follows:

> H_0: As measured by pretests and/or posttests, there is no interaction effect between the development of learner autonomy and computer programming achievement when each is pursued in conjunction with the other.

Research Question Three was addressed by a two-way multivariate analysis of variance (MANOVA). These tests were performed in two sets. Both sets tracked whether a participant completed the course pretest and the LAP pretest as an indicator of whether the subject pursued both achievement and autonomy in conjunction with the other. The first test evaluated the final score with raw LAP total scores (or composite score of all four factors) as the dependent variables. The second test evaluated the final score with LAP total stanine scores (or composite score of all four factors standardized on a nine point scale) as the dependent variables.

MANOVA with Raw and Stanine LAP Scores

The course pretest and LAP posttest were optional course elements for all students, meaning they did not have direct impact on the grade for an individual participant. The LAP pretest was also an optional course element, but was only presented to study participants who had agreed to be part of the study and were assigned to Groups A or B. Finally, the final examination was required for all students and calculated as part of the grade in the course. Thus, running a two-way MANOVA test on both final exam score and LAP pretest includes 65 total cases. Of these, 63 participated in the course pretest and 2 did not. A lower participation rate was seen in the LAP pretest with 24 that participated and 41 that did not (see Table 23). With only two participants that did not take the course pretest, multiple assumptions of two-way MANOVA testing were violated. Specifically, an adequate sample size, multivariate normality, and homogeneity of variance assumptions would require more than one case in each group in order to establish valid results (see Tables 23 and 24).

Table 23

Results for MANOVA on Research Question Three – LAP Raw Scores

	Course_Pretest	LAP_Pretest	Mean	Std. Deviation	N
FinalScore	No	No	87.00	.	1
		Yes	88.00	.	1
		Total	87.50	.707	2
	Yes	No	84.70	14.405	40
		Yes	80.65	18.766	23
		Total	83.22	16.104	63
	Total	No	84.76	14.228	41
		Yes	80.96	18.414	24
		Total	83.35	15.868	65
LAP_Posttest_Raw	No	No	353.0000	.	1
		Yes	385.0000	.	1
		Total	369.0000	22.62742	2
	Yes	No	454.5938	69.18756	40
		Yes	495.5652	53.51047	23
		Total	469.5516	66.50222	63
	Total	No	452.1159	70.13547	41
		Yes	490.9583	56.99331	24
		Total	466.4577	67.81280	65

Table 24

Results for MANOVA on Research Question Three – LAP Stanine Scores

	Course_Pretest	LAP_Pretest	Mean	Std. Deviation	N
FinalScore	No	No	87.00	.	1
		Yes	88.00	.	1
		Total	87.50	.707	2
	Yes	No	84.70	14.405	40
		Yes	80.65	18.766	23
		Total	83.22	16.104	63
	Total	No	84.76	14.228	41
		Yes	80.96	18.414	24
		Total	83.35	15.868	65
LAP_Posttest_Stanine	No	No	1.00	.	1
		Yes	1.00	.	1
		Total	1.00	.000	2
	Yes	No	4.13	2.323	40
		Yes	5.48	2.172	23
		Total	4.62	2.345	63
	Total	No	4.05	2.345	41
		Yes	5.29	2.312	24
		Total	4.51	2.392	65

ANOVA on Final Score

Separate factorial ANOVA tests were run to examine the interaction effects of pursuing the development of course achievement and learner autonomy concurrently. The first test examined the final score as the dependent variable with completion of the course pretest and LAP pretests representing the pursuit of course achievement and learner autonomy respectively. The total number of cases in this analysis included 108. Of these, there was only one participant who did not take the course pretest and did take the LAP pretest. This small group size renders the evaluation of assumptions of normality and homogeneity of variance difficult if not nonsensical to assess. These results are shown in further detail in Table 25.

Table 25

Results for Final Score ANOVA on Research Question Three

Dependent Variable: FinalScore

Course_Pretest	LAP_Pretest	Mean	Std. Deviation	N
No	No	76.25	22.480	8
	Yes	88.00	.	1
	Total	77.56	21.390	9
Yes	No	82.26	15.022	57
	Yes	77.52	18.414	42
	Total	80.25	16.624	99
Total	No	81.52	16.022	65
	Yes	77.77	18.264	43
	Total	80.03	16.967	108

The results of the ANOVA test on the final exam score showed that all results were non-significant. These results are summarized in Table 26.

Table 26

ANOVA Results for Research Question Three on Final Score

Dependent Variable: FinalScore

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	725.888[a]	3	241.963	.837	.477
Intercept	90024.137	1	90024.137	311.284	.000
Course_Pretest	17.078	1	17.078	.059	.808
LAP_Pretest	42.139	1	42.139	.146	.703
Course_Pretest * LAP_Pretest	233.119	1	233.119	.806	.371
Error	30077.029	104	289.202		
Total	722483.000	108			
Corrected Total	30802.917	107			

a. R Squared = .024 (Adjusted R Squared = -.005)

ANOVA on Raw and Stanine LAP Scores

The second set of tests treated the LAP posttest scores as the dependent variable. The raw and stanine score data both included 65 participants in all. Only one participant

did not complete the course pretest and did not complete the LAP pretest. In addition, only one participant did not complete the course pretest and did complete the LAP pretest. Again, the assumptions of the ANOVA were difficult if not nonsensical to assess as shown Tables 27 and 28.

Table 27

Results for LAP Posttest Raw Scores ANOVA on Research Question Three

Dependent Variable: LAP_Posttest_Raw

Course_Pretest	LAP_Pretest	Mean	Std. Deviation	N
No	No	353.0000	.	1
	Yes	385.0000	.	1
	Total	369.0000	22.62742	2
Yes	No	454.7439	68.32401	41
	Yes	496.1250	52.40608	24
	Total	470.0231	65.64785	65
Total	No	452.3214	69.28769	42
	Yes	491.6800	55.90988	25
	Total	467.0075	66.98383	67

Table 28

Results for LAP Posttest Stanine Scores ANOVA on Research Question Three

Dependent Variable: LAP_Posttest_Stanine

Course_Pretest	LAP_Pretest	Mean	Std. Deviation	N
No	No	1.00	.	1
	Yes	1.00	.	1
	Total	1.00	.000	2
Yes	No	4.12	2.293	41
	Yes	5.50	2.126	24
	Total	4.63	2.315	65
Total	No	4.05	2.316	42
	Yes	5.32	2.268	25
	Total	4.52	2.364	67

The interaction effect of $p = .918$ and main effect of the LAP pretest of $p = .421$ on the LAP posttest raw score and $p = .669$ (interaction effect) and $p = .669$ (LAP pretest

main effect) were non-significant, as shown in Table 29 and Table 30 respectively. While the results of the ANOVA tests on both the LAP posttest raw ($p = .022$) and stanine scores ($p = .021$) show a significant result at the $p < .05$ level for the course pretest main effect, this result should be evaluated remembering that the test is evaluating group sizes of 41 and 25 participants with two other groups with only one participant each. Even though ANOVA tests can sometimes be considered robust to violations of normality within groups, this degree of violation is sufficient to cause substantial uncertainty with the results.

Table 29

ANOVA Results for Research Question Three on LAP Posttest Raw Scores

Dependent Variable: LAP_Posttest_Raw

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	46237.060[a]	3	15412.353	3.886	.013
Intercept	1380541.918	1	1380541.918	348.044	.000
Course_Pretest	21932.198	1	21932.198	5.529	.022
LAP_Pretest	2606.310	1	2606.310	.657	.421
Course_Pretest * LAP_Pretest	42.596	1	42.596	.011	.918
Error	249893.936	63	3966.570		
Total	14908561.00	67			
Corrected Total	296130.996	66			

a. R Squared = .156 (Adjusted R Squared = .116)

Table 30

ANOVA Results for Research Question Three on LAP Posttest Stanine Scores

Dependent Variable: LAP_Posttest_Stanine

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	54.326[a]	3	18.109	3.629	.018
Intercept	65.376	1	65.376	13.100	.001
Course_Pretest	28.118	1	28.118	5.635	.021
LAP_Pretest	.919	1	.919	.184	.669
Course_Pretest * LAP_Pretest	.919	1	.919	.184	.669
Error	314.390	63	4.990		
Total	1739.000	67			
Corrected Total	368.716	66			

a. R Squared = .147 (Adjusted R Squared = .107)

Research Question Four

The fourth research question for this study was:

> How do student perceptions of the concurrent training compare to the results shown in the collected data?

Research Question Four was addressed by gathering qualitative data. Twenty-four participants were included in the focus group sessions and follow up interviews. Compiled responses are available in Appendix V. Three themes emerged from the responses. The first regarded the self-assessment of performance across all focus group and interview participants. The second theme emerged across students in the low performing category. All other responses reflected mixed results and a low degree of convergence.

Theme #1: Positive Self-assessment of Achievement

All of the participants in the focus group sessions and follow up interviews evaluated their performance positively. It is interesting to note that all qualitative

techniques took place after the semester had completed and grades had been finalized. There was no difference in the nature of responses between high performing and low performing students as might be expected. A few representative responses appear below:

"It wasn't for my major, and the material was pretty dry for me. I think I did pretty good learning it."

"I'm not a fan of programming, so the course was hard, but I think I did well."

"I did very well. It was an easier class. That helps."

Theme #2: Low Performers Perceived Minimal Impact from Autonomy Elements

While participants in the low performing group still evaluated their performance in the class as high, they were consistent in expressing that the learner autonomy elements such as the LAP surveys and Treatment elements had minimal to no impact on them. This included no impact within the context of the course or outside of the course.

Theme #3: No Convergence in Remaining Responses

In each of the focus group sessions and follow up interviews, the common result was a lack of convergence. Participants expressed a wide degree of opinions as to what did and did not affect their ability to improve their computer programming abilities. Perceived success was attributed to various causes including instructors, course textbooks, online materials, projects, practice exercise formats, tutors, etc. Additionally, impacts from the learner autonomy elements of the course included both positive and negative impacts within the course context and outside of the course context. Some felt that the development of learner autonomy was significant before they came to the course, while others felt that different elements including LAP surveys, video illustrations, goals,

and/or reporting sequences helped to varying degrees. Compiled and summarized results can be seen in Appendix V. Some of the representative comments showing the negative or neutral responses included the following:

> *"I stopped doing it [Treatment] because I was more focused on working on my own work and balance that with being sociable. It had no effect on my studies."*
>
> One participant explained:
>
> *"It [LAP survey] was just a survey. I did it just to be nice and help you with your research study. I didn't have the mindset that I was trying to improve myself. I put it in the back of my mind. That was my fault."*
>
> Another participant added:
>
> *"I never looked at the results [of the LAP survey]. People have to want to make those kinds of changes. There were weeks that I listened to it [the Treatment videos] as I multitasked. I think having the option available in the course helped as a reminder."*

Some of the representative comments showing the positive results from this group included the following:

> *"It [the Treatment of videos, personal goals, and reflection journal elements] didn't really impact me in the course so much. It seemed to have more impact in my daily life than what we were studying. The movies were pretty inspiring. I never thought about them that way. They were good motivation but not too pushy and helped me understand new perspectives."*
>
> One participant described their experience as follows:

"I always have a hypothetical of what I think I'm like. It was interesting to see that [the LAP survey results] to compare to what I thought; to know where I stand. It's always good to look for improvement."

Another participant added:

"It [the LAP survey] makes one reflect on the purpose of education especially after being away for a while. It helped remind me of my goals rather than being in the routine."

Summary of Results

The study examined the effect on both learner autonomy (specifically the *Resourcefulness* of the learner) and computer programming achievement when a course originally designed for traditional computer programming achievement outcomes was redesigned to address lifelong learning skills concurrently. The study addressed four primary research questions. Research Question One, which dealt with the effects of the different experimental conditions on Learner Resourcefulness, was examined using ANOVA tests as described and recommended by Braver and Braver (1988) and Sawilowsky et al. (1994) for a Solomon Four Group Design. The results indicated a non-significant result using raw scores and a significant pretest effect at the $p < .10$ level using stanine scores. The results also indicated a significant interaction effect between the treatment and pretest effects at the $p < .10$ level using raw scores and a significant interaction effect at the $p < .05$ level when using stanine scores.

Research Question Two addressed the effects of the different experimental conditions on student achievement. These effects were examined using ANOVA and ANCOVA tests as recommended by Braver and Braver (1988) and Sawilowsky et al.

(1994) for a Solomon Four Group Design. All tests indicated nonsignificant main effects and interaction effects on student achievement scores.

Research Question Three involved interaction effects between learner autonomy and computer programming achievement when both were pursued in conjunction with one another. The question was examined using MANOVA and ANOVA techniques. Participation in the course pretest was an optional element in the course. However, a high response rate on this achievement pretest resulted in a low number of cases for comparison. This resulted in the violation of several assumptions of the MANOVA test and the ANOVA tests. Since ANOVA is often seen as somewhat robust to these violations, the test results were reported as nonsignificant on student achievement. The course pretest appeared to have a significant result at the $p < .05$ level on learner autonomy. However, the violation of test assumptions calls these results into question.

Research Question Four sought to compare student perceptions of the experience with the quantitative results of the study. Focus group and interview data yielded three themes including: 1) positive self-assessment of achievement for all respondents 2) perception of minimal to no impact from autonomy elements by low achievers and 3) no convergence in remaining responses regarding the development of computer programming ability, learner autonomy, or the interaction of the two factors within the context of the course or outside of the context of the course.

These results present some intriguing results that can be interpreted using modern instructional design and education theories. These results will be discussed and interpreted in further detail in chapter V.

CHAPTER V

Discussion

This study examined the effects on both learner autonomy (specifically the *Resourcefulness* of the learner) and computer programming achievement when a course originally designed for traditional computer programming achievement outcomes was redesigned to address lifelong learning skills concurrently. A sample of 120 participants consented to be part of the study. Each student was randomly assigned within sections to one of four different study conditions based on the Solomon Four Group Design. The study found mixed results that will be discussed in this chapter.

Interpretation of Results

The various findings of this study will be discussed in further detail in this section. First, main effects and interaction effects of the LAP pretest and treatment will be interpreted for their impacts on Learner Resourcefulness in response to the first research question. Second, main effects and interaction effects will be examined for their impacts on student computer programming achievement in response to the second research question. Third, the interaction effects of participation with the course pretest and LAP pretest will be used to interpret the impacts of pursuing learner autonomy and computer programming achievement concurrently. Finally, the comparison of quantitative study results with qualitative responses from student focus groups and interviews will be interpreted in response to the fourth research question.

Interpretation of Effects on Learner Resourcefulness

The instructional intervention was designed to increase a lifelong learning skill with either a positive or neutral impact to the achievement-oriented focus of the original design.

The study findings indicated that the LAP pretest resulted in a significant difference in the development of Learner Resourcefulness (one of the four factors of learner autonomy). This can be seen in the comparison plot in Figure 6. In contrast, the treatment appears to have had a negative, but nonsignificant result in terms of decreasing the Resourcefulness posttest scores as shown in Figure 7. These graphical illustrations are corroborated by the effect size calculations which showed that the pretest effects were stronger than the treatment effects. It is also important to note that the lines in these figures do not denote change over time, but are used to help show consistent, parallel separation of the composite groupings of LAP survey as pretest (Groups A and B) and no LAP survey as pretest (Groups C and D) along with Treatment (Groups A and C) and no Treatment conditions (Groups B and D) respectively. As pointed out by numerous advocates of the Solomon Four Group Design, it is important to recognize the significance of pretesting effects in pretest/posttest research study designs (Solomon, 1949; Bracht & Glass, 1968; Willson & Putnam, 1982; Oliver & Berger, 1980; Braver & Braver, 1988). In many cases, the effects of the pretest can obfuscate or overwhelm the treatment effects. Contemporary statistical methods can help sift through the level and degree of each of these effects.

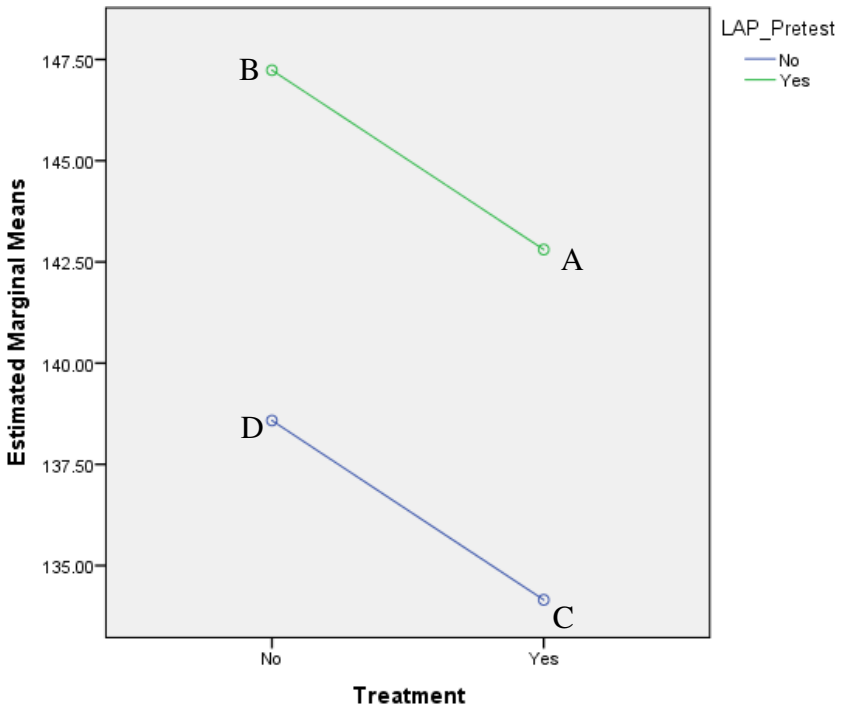

Figure 6. LAP Pretest Main Effect on Resourcefulness Subscale by Treatment Condition

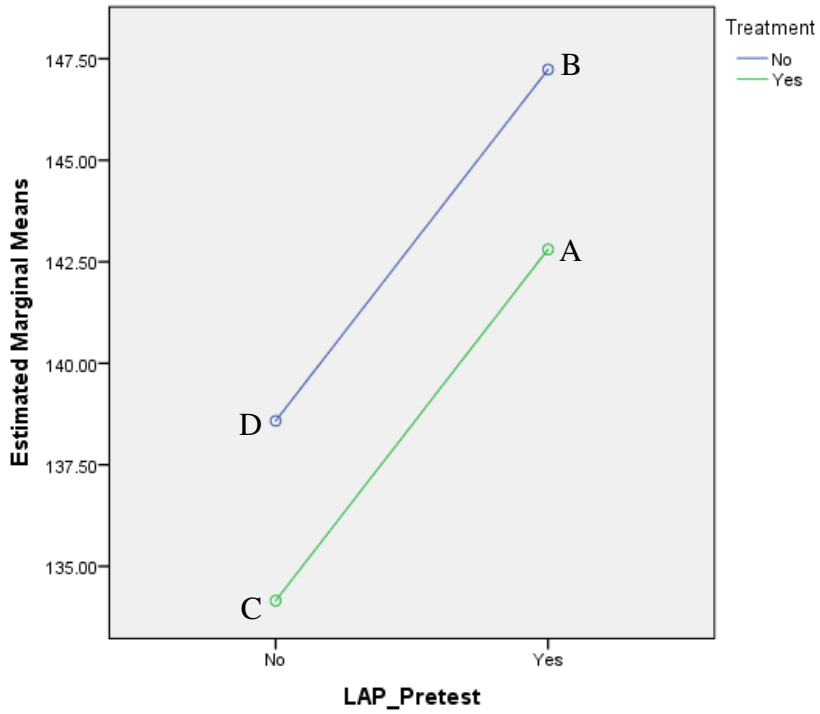

Figure 7. – Treatment Main Effect on Resourcefulness Subscale by LAP Pretest Condition

The interaction of the LAP pretest and treatment conditions can help shed light on these complex, interwoven factors. The study findings showed an interaction effect where being part of any of the conditions such as LAP pretest or treatment resulted in increased scores over the control group who was not involved with any of the instructional intervention treatment elements. However, the group that received both the LAP pretest and treatment conditions experienced the lowest degree of increase compared with the LAP pretest only and the treatment only groups. Visualizing the interaction effects by contrasting the conditions in Figure 8 can help illuminate this result. This interaction effect could be interpreted as meaning that either condition of LAP pretest or treatment was beneficial, but that the combination of LAP pretest and treatment resulted in too much of a cognitive load and had a decreased effect on the development of Resourcefulness.

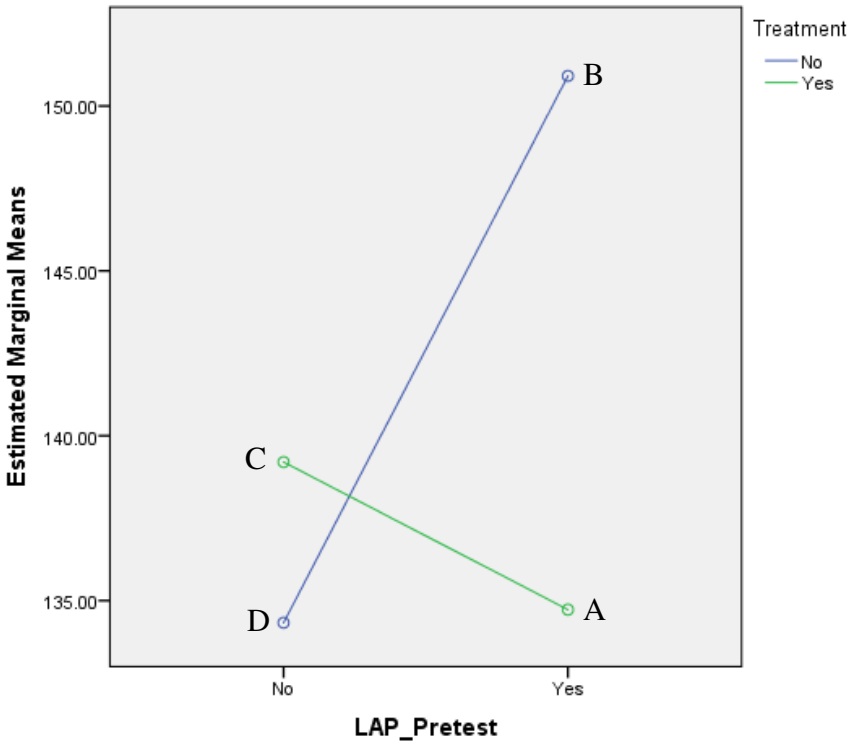

Figure 8. LAP Pretest and Treatment Interaction Effects on Resourcefulness Subscale

Interpreting the meaning of outcomes from complex phenomena such as apprehending the means by which a large number of learners are changing is challenging at best since only small subsets of the possible factors of learning can reasonably be captured for a group of learners. The findings of this study may not be generalizable due to the personological variables of religious affiliation and high levels of prior religious missions. The relationship between voluntary religious service and learner autonomy has not been established in the research literature. However, there may be reason to suspect that there would be a difference between those who volunteer for such service and those who do not that may have been present in various degrees within the groups of the study or which may have influenced the study results in ways that were undetected.

Other undetected effects include the effects from the individual components of the treatment. As this was a composite treatment, the individual videos, goal setting patterns, reflection sequences, and other factors were not captured and analyzed individually. It is possible that the combination of effects may have resulted in multiple treatment interference. The combination of these elements may have had amplifying or dampening effects on one another which could not be separated or quantified.

There is a possibility that some of the results from the main effects or interaction effects may be due to statistical regression. This can occur when extreme scores occur within a particular group or groups due to unknown causes for instability, uncertainty, or chance. Participants were selected into groups at random rather than based on scores to minimize this risk.

There seems to be little reason to suspect that any of the results of this study were due to maturation effects. Maturation effects are less common in adults than in younger

children. Maturation effects are also more common over a period longer than six weeks. While there was a very small number of participants that were age seventeen, these younger participants were evenly distributed across the groups.

Interpretation of Effects on Computer Programming Achievement

The study findings on Research Question Two showed that there were no significant main effects or interaction effects on achievement. The LAP pretest resulted in a nonsignificant or minimal decrease in final scores. On the other hand, the treatment had a nonsignificant positive impact on final scores. These results were corroborated by the effect size calculations which showed that the pretest effects were stronger than the treatment effects. The instructional intervention appears to have achieved the desired goal of accomplishing a positive or neutral impact on student computer programming achievement.

There may have been some novelty or disruption effect from introducing the treatment during the middle of the semester. Additional exams surrounded the period of the treatment and can provide some degree of insight. However, due to slight differences in course schedules, delivery between sections, and the less synchronous nature of the online course, the LAP pretest and treatment started somewhere between more than one week prior to one week after the first exam of the course. The second exam took place somewhere between two to four weeks after the LAP pretest and treatment began. Thus, obtaining timing dependent data for deriving novelty effects was not possible.

The interaction of the experimenter with the participants was controlled by channeling all course related interactions and communications through the course instructors. The experimenter developed the instructional materials to be delivered

through the institution's learning management system. Communications with participants came through the e-mail features in this learning management system. Questions and other interactions of course participants were channeled through the course instructors wherever possible in order to minimize experimenter effects.

However, it is possible that instructor effects may have been present that would not be generalizable. This is why the study design took on a stratified design where sections were assigned at random by instructor and then students within those sections were assigned to treatment conditions at random. In testing for instructor effects, no significant differences were found in the LAP and Resourcefulness subscale pretest scores. A significant difference was found in the course pretest scores of student achievement. In looking into the data, it appears that less synchronous nature of the due dates for assignments in the online course meant that several participants had completed several assignments and been exposed to more of the course subject matter prior to taking the course pretest than in the face-to-face courses. Significant instructor effects were found in the course final exam scores ($p < .01$ level) and Resourcefulness posttest scores ($p < .10$ for both raw and stanine scores). These findings appeared to be related to differences between the online and the face-to-face delivery formats. However, since the course materials and exam pretest and posttest scores have not been published for more general use, the measurement of scores related to these outcomes means that the results may not be as generalizable as the LAP results.

There was a potential for timing differences to have had some effect on the study findings. The timing of many of the course and treatment elements took on a range over several weeks due to the asynchronous nature of assignments, due dates, incentivized

elements, and delivery formats. There was a one to three week period as participants completed the treatment, LAP posttest, and the course final exam. All of the timing for the study elements were intentionally designed to match the timing and rhythms of other course components.

Interpretation of Pursuing Learner Autonomy and Achievement Concurrently

The study findings for Research Question Three were inconclusive due to violations of the assumptions for the MANOVA and ANOVA tests used. One potential explanation for the lower numbers of participants who did not complete the course pretest and/or the LAP pretest is due to the opt-in requirement for study participation. The target institution policies are to give students one week at the beginning of a semester to enroll in the course, get familiar with the syllabus, requirements, instructor, culture, and other characteristics of the course in order to determine whether to maintain enrollment. Those who fail to opt out are then treated as if their enrollment signified consent to all obligations and expectations of the course including financial obligations according to established deadlines and policies. The opt-in requirement for this study resulted in a loss of over sixty potential study participants. It is important to note that other studies, including those in the healthcare field, have concluded that opt-out models are an acceptable format even for medical research (Vellinga, Chormican, Hanahoe, Bennett, & Murphy, 2011), which is typically considered more sensitive in the United States. Other studies conclude that opt-in models also introduce bias (Junhans, Feder, Hemingway, Timmis & Jones, 2005), since they deviate further from the actual results (Cassell & Young, 2002). Opt-in models are more commonly ruled out when dealing with children,

vulnerable populations, or would place participants in unusual circumstances or more than minimal risk (Alderson & Morrow, 2004; Farrell, 2005; Graham, Powell, Anderson, & Fitzgerald, 2013; Gorard, 2002).

The instructional design and experimental design facilitated a high degree of autonomy that affected the level of participation. Thus, it is possible that experimental mortality effects may have occurred where the differential loss of participants from the various groups affected the study findings. However, as this result was by design, the risk was deemed not only acceptable, but desirable. Ideally, the degree of this effect would be detectable. The number of participants at each stage and the number of cases that could be included in each statistical analysis shown in chapter four provide precision in identifying the differential degrees of mortality for each component of the study. However, the level or degree of these effects could not be captured or reported other than to identify the violation of test assumptions that occurred.

Interpretation of Student Perspectives Compared with Study Findings

The study findings for Research Question Four showed that while the quantitative comparison of student achievement and learner autonomy is individual for each participant. Therefore positive, negative, or mixed interpretation of the comparison of student perspectives against the study findings could be argued. The personal perspective of the students within themselves was positive for computer programming achievement and mixed for the development of learner autonomy.

One point of concern with the self-assessment format such as the LAP is the accuracy of the results, which have been found to provide stable, useful, and accurate information in some cases, and inaccurate data in others (Fitzgerald, White & Gruppen,

2003; Davis, Mazmanian, Fordis, Van Harrison, Thorpe, & Perrier, 2006). One theme that emerges from the research literature is that self-assessment should be used as a process and not a product (Taras, 2010; Boud, 2013; McMillan & Hearn, 2008). Theme One of the study findings showed that all participants in the focus groups and interviews viewed their achievement with computer programming positively while they viewed the development of learner autonomy as a mixed result. These perceptions were gathered after exam scores and LAP results had been reported back to the participants. However, all participants had reviewed their exam scores, while not all participants had reviewed the LAP results that had been sent via electronic mail. This difference in the process from the student perspective may have influenced their perception in a variety of different ways.

Interestingly, Theme Two highlighted a perception among low performers that the autonomy elements of the course had minimal to no impact on them. Data analyses for Research Questions One and Two were repeated with only low performers included. It should be noted that when this analysis was performed on the filtered results, the sample size was greatly reduced since the number of low performers was small (n = 11 for Research Question One on Learner Resourcefulness posttest scores and n = 27 for research question two on final exam scores). While the direction of all main and interaction effects was maintained, all results were nonsignificant. Therefore, the comparison showed that the qualitative reporting of student perceptions matched the quantitative results of the study.

While the definitions of the factors, constructs, and course outcomes are well defined and have been validated through various processes for both the Learner

Autonomy Profile and the course exams, participants did not always share these same definitions or were unsure what they meant. It is likely that this also influenced potential discrepancies between the student perceptions and the quantitative results in the study.

The presence of a Hawthorne effect, where people act differently during a research study compared to other more normal circumstances, was not directly measured in this study. During the focus group and interview stage, participants were asked whether knowing they were part of a research study affected them. The majority of participants claimed that they experienced either no or a very minimal effect. However, a small minority responded that they consciously acknowledged an effect. In the words of one participant "It motivated me to always participate because it will be applied in helping other students to learn more effectively in the future." This may have influenced the results in ways that may not have been fully detected or that would be fully generalizable.

It should also be noted that the focus groups and interviews took place after a holiday break in semesters. This effect was reflected in some student responses during the focus group and interview sessions. This primarily related to participants who took some time to recall their experiences with the course after the break, which may have influenced some of their responses.

Implications for Practitioners

The primary implication of this study is that Learner Resourcefulness can be significantly influenced even in courses that have a high degree of focus on achievement. The findings in this study should encourage instructional design efforts to continue to seek out means and techniques to incorporate and reinforce lifelong learning and learner

autonomy habits, skills, and dispositions in conjunction with knowledge and skill outcomes. While some may continue to have concerns over what they feel may be distracting learners away from the knowledge- and skill-based outcomes of a course, facilitating students in a more holistic fashion as they develop and build capacity toward learning-to-learn is possible. Balancing the amount of workload and the types of methods used in conjunction with one another still appears to be a delicate goal.

This study agreed with several findings from Lowe (2009) in that the relationship between student achievement (or GPA) and lifelong learning is rather small, but significant at least in some degree. A relationship between the two has been intuitively sensed and assumed by many and studies seem to bear out that the relationship exists. Whether the relationship is linear, non-linear, circular (see Snow, Corno, and Jackson, 1996), or bi-directional in nature, it is clear that there is a relationship and that pursuing both concurrently appears to be a worthwhile area of practice and research. In other words, pursuing achievement and autonomy concurrently seems to be more an issue of how it is done rather than whether it can be done.

Resourcefulness continues to hold a place in the research literature as the learner autonomy factor with the greatest impact and strongest relationships with other outcomes and variables of interest. In this study, questions relating to Resourcefulness held some degree of statistical significance where composite measures of learner autonomy were found to be non-significant. These findings agree with those of Ponton, Carr, and Derrick (2004), Lowe (2009), Ng et al (2011), and Buvoltz et al (2008), and involving Resourcefulness, and Sanders (2006) involving learner autonomy as a composite. Thus,

practitioners should recognize the key role of Resourcefulness in the development of learner autonomy and lifelong learning.

Suggestions for Further Research

The results of this study point to several opportunities for beneficial future research. The practical constraints of the number of participants available in this study mean that it can and probably should be validated with a larger number of participants. Planning for more conclusive studies should include expectations for higher mortality rates especially when building autonomy in as an instructional feature. It also remains to be seen whether there a particular pairings of lifelong learning skills that match up well with a variety of course topics and skill targets.

In this study, the instructional intervention included numerous instructional features including pretest and posttest formats, autonomy, video illustrations from mainstream media, predefined goal and customized goal option sets, and brief reflection opportunities in the form of an online reporting journal. Each of these instructional features should be examined separately to understand more clearly their individual impact on both learner autonomy and achievement when pursued in conjunction with one another. Various configurations of these instructional features in different sequences or in connection with other instructional features would be potential areas for exploration and examination.

As for the use of multimedia, Mayer has led the charge in providing input and research studies on improving the quality and effectiveness of multimedia instruction (see Mayer & Moreno, 2003; Clark & Mayer, 2011; Mayer & Pilegard, 2014). This study made use of several multimedia principles such as segmenting, weeding, signaling,

aligning, and eliminating redundancy. According to the literature, further refinement of the training should probably include improved pretraining (through the audio channel rather than written text), synchronizing, and individualizing to further increase the effects. Practitioners should ensure that these efforts result in an increase in quality of the presented multimedia and learning effects while minimizing extra time and processing requirements on the part of the learner.

This study focused on how lifelong learning skills and computer programming achievement could be pursued in a formal, higher education setting. How these elements relate to and impact one another in other settings such as primary or secondary schools, higher level courses in undergraduate and graduate courses may vary from the results seen here. Informal and non-formal settings provide opportunities for understanding the development of achievement and lifelong learning skills in conjunction with one another.

Alternative means of assessment as another field of instructional design research could yield additional insight. The Learner Autonomy Profile has never been cross-validated with other lifelong learning assessment instruments such as the Effective Lifelong Learning Inventory. Both of these instruments are conducted in self-assessment formats, so comparison would be interesting from an academic perspective. However, their length, scope, and overlap between constructs may cause conflicting results for study participants who may be asked to complete both assessments within a short time frame.

Evaluating the Learner Autonomy Profile or other lifelong learning instruments externally would provide additional validation to their results. For example, the Belbin Team Roles Inventory includes a method of behavioral analysis by trained external

observers (Belbin, 2012). This approach provides a means for cross-checking the results of self-assessments against performance in actual practice.

The scope of the study was bounded to individual-based instruction due to the desire to limit the time expectations involved. Dunlap and Grabinger (2003) also point to the importance of collaboration as an instructional design feature to enhance lifelong learning. Research also points to how social interactions can change perceptions of time investment (see McGrath & Kelly, 1986). Design of collaborative and social learning activities has been highlighted as an additional component that should be formally evaluated.

Derrick, Ponton, and Carr (2005) discovered higher LAP scores in a preliminary analysis of students enrolled in online versus face-to-face delivery formats. That study included only eighteen total participants. The current study verified those results as the online participants had higher total LAP scores ($m = 483.13$, $n = 18$) than the face-to-face participants ($m = 461.09$, n = 49). The total scores showed a non-significant result $t(65) = 1.198$, $p = .235$ at the $p < .10$ level (see Appendix W for full results). Resourcefulness raw scores were significantly higher $t(65) = 2.188$, $p = .032$ at the $p < .05$ level for the online participants ($m = 151.19$, $n = 18$) than the face-to-face participants ($m = 137.25$, $n = 49$). Appendix X contains the full results of the comparison of delivery formats on Resourcefulness. The reasons for this difference have yet to be fully explored, but seem at the surface to be related to self-selection effects.

The research design methods of this study could be varied to explore differences in the results. The Solomon Four Group Design helped to capture and describe the pretest effects in this pretest and posttest research design. With the advancements in data

collection options in online course settings and advancements in statistical analysis methods and software, complex and rich study designs are becoming increasingly viable. Hierarchical modeling or other emerging statistical methods could also prove useful with similar subject matter.

Conative psychological constructs (the will), learner autonomy, lifelong learning, and learning-to-learn skills are all broad and deep areas for further research. A variety of methods and theories have yet to be examined at the course and lesson level as well as at the long-term level. These topics seem to blend well with theories in complexity theory. For example, one research team recently examined autonomy and risk taking in a computer programming class using qualitative methods and a more open instructional design approach. The results were reported in a fairly new research journal titled *Complicity* (Barney & Maughn, 2015).

Conclusions

While studying multiple educational outcomes concurrently is a challenging task, the results can help to shed light on a few of the complex interactions and variables at work in an educational setting. The trend toward an increasing pace and increasing expectations of our modern age seem to demand increasingly holistic approaches to instructional designs and educational offerings. Examining multiple elements and their influences on one another can help bring a more complete understanding to learners and educators in a variety of learning settings. The Solomon Four Group Design was indispensable in helping to identify the presence and degree of influence of pretests in the study. The statistical analysis required for this design has been rendered far less cumbersome by modern computer software. This and other complex or

advanced research designs will likely be increasingly more relevant for complex topics such as education research in the future.

This study set out to examine the effect on both learner autonomy (specifically the *Resourcefulness* of the learner) and computer programming performance when a course originally designed for traditional computer programming performance outcomes was redesigned to address lifelong learning skills concurrently. Learner Resourcefulness was significantly impacted by both the Learner Autonomy Profile when taken as a pretest and more significantly impacted when combined with an instructional intervention including video illustrations of abstract learning skills taken from mainstream media, participant selected goal setting, and reflection through online reporting. Student achievement in computer programming was not significantly impacted. Results on the interaction of pursuing both achievement and learner autonomy concurrently were inconclusive due to the small number of cases of participants who did not pursue both outcomes concurrently. Finally, qualitative data collection revealed that there was little to no convergence in student perceptions of the instructional intervention and LAP pretest. Two themes including positive self-assessment of achievement for all focus group and interview participants and the perception of minimal to no impact on learners from the pretests and learner autonomy elements emerged from qualitative data collection and analysis. These themes did not fully agree with the quantitative findings of the study.

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APPENDIX A

Mission Statement Analysis for Idaho Institutions of Higher Education

Mission Statement Analysis for Idaho Institutions of Higher Education

Idaho-based Institutions of Higher Learning

Code	Count	Percent	Cumulative
x	7	50%	50%
p	6	43%	93%
o	1	7%	100%
Total	14	100%	

Idaho Registered Institutions of Higher Learning

Code	Count	Percent	Cumulative
x	16	53%	53%
p	8	27%	80%
o	6	20%	100%
Total	30	100%	

Analysis Table

Home	Name	Mission
x	Boise Bible College	o
x	Boise State University	x
x	BYU-Idaho	x
x	College of Idaho, Caldwell	p
x	College of Southern Idaho	p
x	College of Western Idaho	x
x	Eastern Idaho Technical College	x
x	Idaho State University	p
x	Lewis–Clark State College	x
x	New Saint Andrews College, Moscow	p
x	North Idaho College	x
x	Northwest Nazarene University, Nampa	x
x	Stevens-Henager College	p
x	University of Idaho	p
	Biblical Studies Center-Boise	o
	Broadview University, Meridian	o
	Brown Mackie College, Boise	x
	Carrington College, Boise	o
	Concordia University, School of Law, Boise	x
	Embry Riddle Aeronautical University	p
	ITT Technical Institute, Boise	x
	Lane Community College	x
	Lesley University	x
	Northwest University, Nampa	p
	Nova Southeastern University	x
	Park University	x
	Treasure Valley Community College	o
	University of Phoenix, Meridian	x
	Webster University	x
	Western Governor's University	o

Legend	
Home	= Headquarters or Primary Campus physically located in Idaho
x	= full match
p	= partial match of lifelong learning terminology
o	= no significant match of lifelong learning terminology

APPENDIX B

Informed Consent

Informed Consent

TO: [Course Code] Students
SUBJECT: Informed Consent for Research Study

You are invited to be part of a research study. Please confirm that you have received this message and are willing to participate by clicking on and sending this Automated Response [hyperlink has been removed].

The purpose of the study is to examine the effects of course activities that are designed to help you become more aware of how to learn or learning habits that you can develop while you are learning in a higher education setting. You were selected as a potential participant because you are enrolled in [Course Code].

Your participation in this study is voluntary. Your decision about whether to participate in the study will not affect your course grade, scores, or required work in the course. Regardless of your decision, you will still be responsible for completing all required work as part of the normal grading procedures for the course.

If you choose to participate in the study, your scores will be used in the research analysis. Any identifying information requested for the study will be used solely to match records across collected data sets and then made anonymous. The final results of the study will be published as aggregated totals and subset totals only. Your individual scores and records will **NOT** be included in the publication. The published results will **NOT** include your name, scores, or any other information that could allow someone to identify you or match any piece of information to you individually.

All students in the course who choose not to participate in the study will still be required to complete course pretests and regular examinations that are part of the course. However, score data will **NOT** be analyzed or reported as part of the study results. Participants in the study will be randomly assigned to various conditions that may require personal evaluation of learning habits along with weekly training and reporting processes that are anticipated to take between 5-15 minutes on a weekly basis over a period of six weeks. It is anticipated that the time involved with the study will total between 2-4 hours over that period.

A limited number of participants will be selected to participate in a focus group session at the conclusion of the study. The purpose of the focus group will be to gather your perceptions of the study. Audio recordings and transcriptions of these sessions will be made and stored on a [institution] issued laptop and protected by institutionally defined information security controls to aid the researcher in analyzing the results. The recordings and transcripts will be accessed only by the researcher, the faculty advisor on the project, and/or trained employees at Idaho State University who deal with sensitive research materials on a routine basis. All recordings and transcriptions will be destroyed upon completion of the study and approval of the study findings.

This research study is being conducted by Kory W. Godfrey [title and name of institution removed]. Please contact him if you have any questions about this consent form or the nature of the research study.

Please reply to this message or notify the primary researcher at [email address] or contact your instructor to confirm your consent to participate in the study.

APPENDIX C

Instructional Design Documents – Project Rationale

Project Rationale

The [institution] mission statement (along with many other institutions of higher learning) advocate the virtues of preparing students for "lifelong learning". The purpose of this mission element is to enable the learner to develop more holistically in both achievement (knowledge and skills) along with increasing their capacity for learning. It is theorized that these more abstract skills are more naturally transferrable and therefore better suited for equipping a learner for the rapidly changing world we now experience. The rationale for targeting Learner Resourcefulness is to equip learners to grow in their capacity to be able to grow and persist in autonomous learning throughout increasingly challenging course material in later upper division information technology courses and professional grade learning habits for both career and life.

NOTE: The focus of the accompanying study is to provide a starting point for integrated study methods including the effects of instructional design interventions on more than one faculty of the mind (e.g. cognition, conation, and affections) simultaneously. As the course has already been developed primarily for cognition and approved as such. The research design will target the conative factor of resourcefulness and will be created and approved through separate processes. The remaining instructional design documentation will treat only the Learner Resourcefulness elements of the design and treat the course material and accompanying study only tangentially as background information less relevant to the instructional design process for the instructional intervention.

APPENDIX D

Instructional Design Documents – Project Objectives

Project Objectives

To aid in understanding, the following objectives are presented using a color-coding scheme (see the explanation below). Each is written in a Mager (four-part) format.

The Audience is indicated in blue text.
The Behavior is indicated in orange text.
The Condition is indicated in red text.
The Degree is indicated in green text.

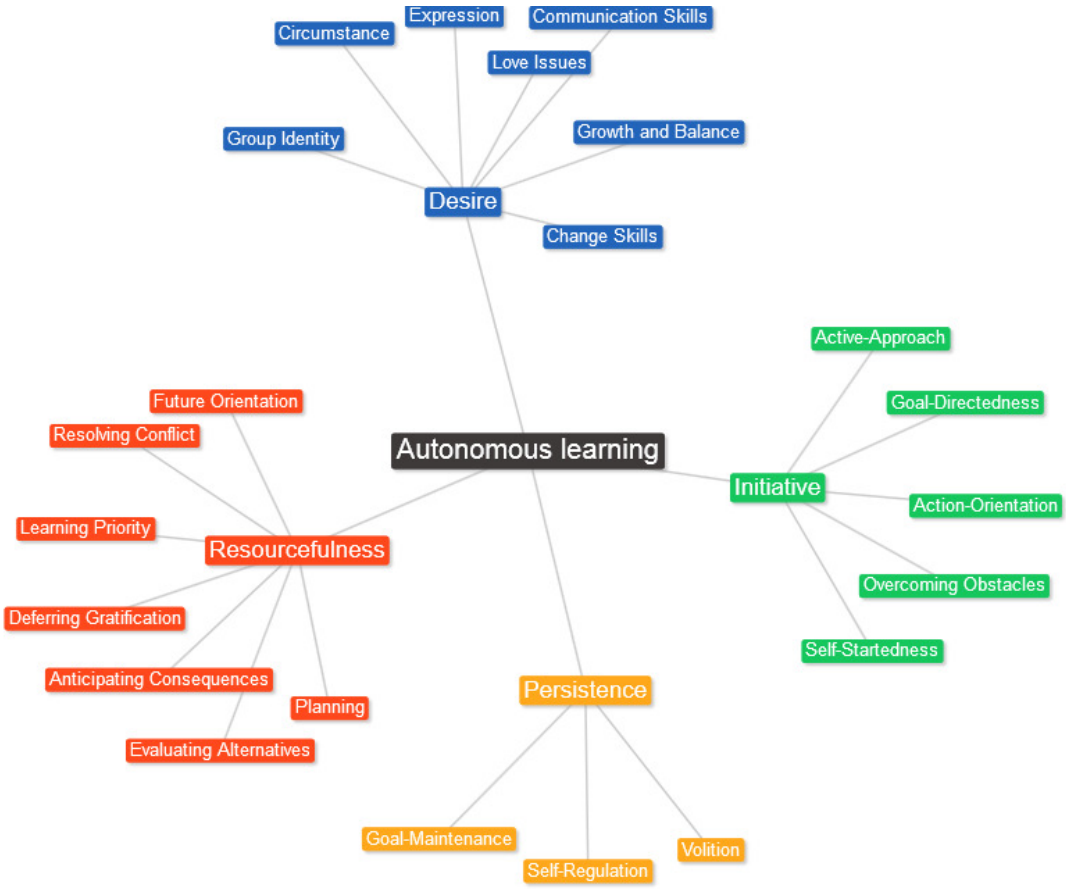
Objectives

1. Given an instructional module on Learner Resourcefulness, the undergraduate level computer programming student will demonstrate improvement in Learner Resourcefulness as measured by the Learner Autonomy Profile (LAP) instrument.

APPENDIX E

Instructional Design Documents – Project Concept Map

Project Concept Map



APPENDIX F

Instructional Design Documents – Learner Influences Document

Learner Influences Document

Item/Event	Strategies
1. What events will the instructional designer utilize to gain the learner's attention?	Video introducing the subscales of Learner Resourcefulness using MacGyver problem solving
2. What techniques will the instructional designer use to maintain the learner's attention?	Overlay titles for resourcefulness subscales with MacGyver in action. Use similar tags and prompt elements in subsequent course materials.
3. What events will the instructional designer provide to stimulate recall of prerequisite knowledge?	Invite learners to reflect on experiences where they have been successful with resourcefulness strategies or had opportunities to make use of resourcefulness skills in practice.
4. How will the instructional designer communicate the learner's responsibility?	Introduction video, question and instruction prompts to invite reflection and autonomy
5. What techniques will the instructional designer use to inform the learner of expected instructional outcomes?	LAP survey pretest, results, and introduction video will inform learners of expected instructional outcomes.
6. What techniques will the instructional designer employ to produce inquiry?	Self-reflection and monitoring prompts such as: Stuck? What learning resources and relationships do you have available to you?
7. How will the instructional designer enhance the learner's recall of the material (i.e., short-term memory)?	Reference back to MacGyver example and prompts. Additional case examples and options may be helpful in providing autonomy features.
8. How will the instructional designer elicit learner participation?	Invitations to apply, reminders, reflections, forward planning and commitments.
9. How will the instructional designer utilize feedback gathered from the instructional and the practice materials?	Implementation of instructor discussion boards, tutors, etc inviting student to seek out a wide variety and quantity of mentoring relationships and resources for helps. Training for instructors to monitor poor performers or those who could benefit from resourcefulness and how to engage with them through messaging, feedback, and mentoring mechanisms in the online environment.
10. What learner capabilities will the instructional designer develop as an outcome?	Development of resourcefulness habits.
11. How has the instructional designer responded to any particular learning trait?	Learner Resourcefulness – Learner Autonomy – Self-Directed Learning – Lifelong Learning and their relationships to developing new knowledge and skills in computer programming. Integration and mutual reinforcement of these outcomes is the target of the study.
12. How will the instructional designer assess learner satisfaction with the instruction?	LAP instrument, course assessments, course evaluations.
13. How will the instructional designer accommodate any learner disability (psychomotor, cognitive, emotional)?	YouTube closed captioning, university resources for learner disabilities.

APPENDIX G

Instructional Design Documents – Learning Outcome Statement

Learning Outcome Statement

Objectives

1. Given an instructional module on Learner Resourcefulness, the undergraduate level computer programming student will demonstrate improvement in Learner Resourcefulness as measured by the Learner Autonomy Profile (LAP) instrument.

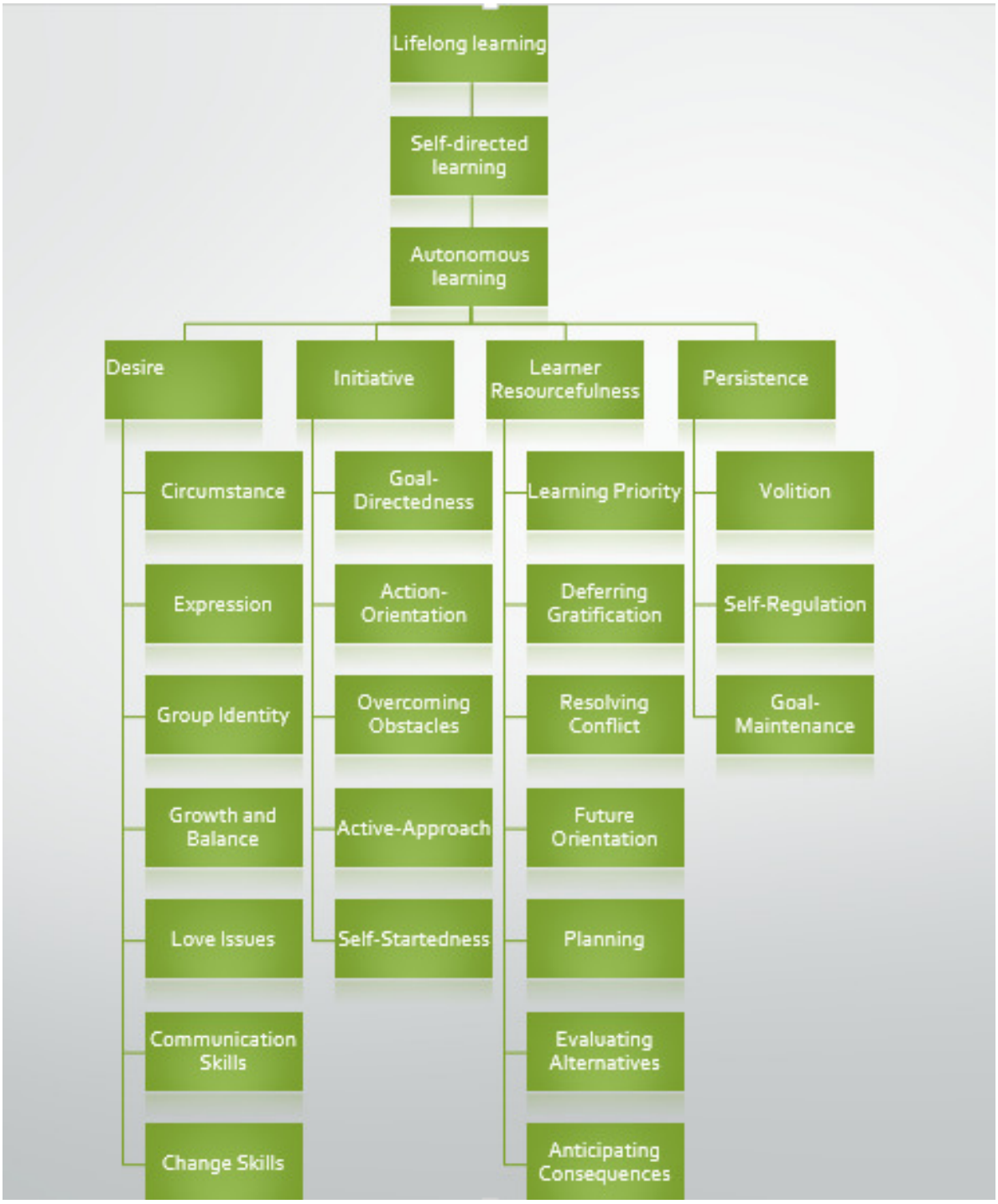
Outcomes

1. The student's ability to apply resourcefulness strategies in order to accomplish personal and professional learning goals will increase.
2. The student's ability to succeed in a variety of challenging learning and performance endeavors will increase.

APPENDIX H

Instructional Design Documents – Learning Hierarchy

Learning Hierarchy



APPENDIX I

Instructional Design Documents – Learner Characteristics Profile

Learner Characteristics Profile

General Information

Topic	Data Collected	Resources Used
1.0 General Characteristics of the Target Population	The targeted population is college level students in an introduction to computer programming course.	School records
1.1 Age Range	53% range from 18 to 24 years.	School records - population
1.2 Gender Distribution	The historical distribution of participants in the course is predominantly male.	Experience of instructors from prior courses
1.3 Special Needs	Historically less than 1%	Experience of instructors from prior courses
1.4 Ethnic/Cultural Background	89% white, 6% Hispanic	School records - population
1.5 Language Distribution	Predominantly English as a first language. Roughly 5% English as a second language	Experience of instructors from prior courses

Academic Information

Topic	Data Collected	Resources Used
2.0 What entry behavior(s) is needed for learner success?	Appropriate reading and learning management system abilities	School records and experience
2.1 What is the attitude toward target content material?	The majority of the students are computer information technology majors, however a variety of all other majors have enrolled. Many students appear to struggle with learning programming patterns, and some students exhibit frustration during laboratory work. Prevailing sentiment towards the class is typically positive especially at the beginning of the semester. Some negative attitude indicators sometimes appear in class experiences and in course evaluations.	Teacher observation, student history, and survey data.

Topic	Data Collected	Resources Used
2.2 What is the learning preference(s) or modality?	There are three categories of learning modalities: verbal/auditory, visual, and kinesthetic. Students most commonly identify themselves as visual or kinesthetic learners and claim this is why they chose the class – in order to work directly with a computer and see the tangible results.	Teacher observation and experience.
2.3 Is it reasonable to expect that the material to be cognitively learned by these learners?	The majority of information technology majors have performed well enough to receive passing grades within the time period specified and have performed well in subsequent classes that implement programming projects. Resourcefulness is a key element of lifelong learning that needs to be strengthened. It is believed that the majority of students can develop this learning habit if given proper support, help and encouragement.	Instructor experience and School records
2.4 What is a reasonable time frame for the targeted content to be mastered?	Students are in class 3 hours a week with an expectation of 6 hours per week outside of class in study time for a rough total of between 120-130 hours through the 14 week semester. Resourcefulness patterns will be targeted for 4-6 weeks of the instructional period or during 35-55 of those hours.	University guidelines
2.5 What is the motivation for the learner to complete this targeted content?	Completion of this undergraduate course is a prerequisite for many majors, minors, and clusters. The course is also recommended by many employers and advisors as an elective credit.	University requirements employer/advisor recommendations

Prior Information Needed

Topic	Data Collected	Resources Used
3.0 What prior knowledge is needed for learner success?	Eligibility as a university student. Assumption of college level mathematics similar to MATH 108 Prerequisites: Students must have an ACT Math score of at least 18 or an SAT math score of 430 or ALEK test score of 120 or MATH 100B with a B or MATH 101 with a B or MATH 100G with a B	University requirements departmental guidelines instructor experience,
3.1 What prerequisite cognitive skills are needed for learner success?	Eligibility as a university student. Familiarity with a learning management system or online courses for successful navigation of course materials is recommended, but does not preclude registration for the course.	University requirements departmental guidelines instructor experience,
3.2 What prerequisite motor skills are needed for learner success?	Familiarity with a learning management system or online courses for successful navigation of course materials is recommended and typically achieved, but does not preclude registration for the course.	University requirements departmental guidelines instructor experience,
3.3 What previous experience would the learner have that would inhibit success?	Some students have taken prior programming courses that were too difficult, too far outside their frame of relevance, or taken at a pace beyond their ability to keep up. Students may have assumed less optimal habits, attitudes, or paradigms from these experiences.	Teacher observation, student history, and course evaluation data.

APPENDIX J

Instructional Design Documents – Target Audience Statement

Target Audience Document

1.0	Describe the learners who will be directly affected by the instruction; e.g., grade level(s), specific academic discipline, geographic location, etc.	The targeted learners are undergraduate level students enrolled in an introductory computer programming course at [institution].
2.0	Identify the age range of learners who will receive the instruction.	The targeted learners will range in age from 18 up to 35 with the majority (over 90%) falling between 18 and 24 years of age.
3.0	Provide the time(s) and date(s) the instruction will take place.	The instruction will take place during a 4-6 week period of a regularly scheduled semester long course.
4.0	Identify and describe in detail the location where the instruction will take place.	The instruction will take place via video and other multimedia presentations, written assignment instructions, and discussion boards within a learning management system that is currently implemented for both face-to-face and online courses at the university. Course participants will be primarily located near Rexburg. However, due to the nature of the instructional materials and format these participants could theoretically be dispersed throughout the world. It is a requirement of the course that each learner will be responsible for ensuring access to an adequate Internet connection.

APPENDIX K

Instructional Design Documents – Pedagogical Considerations Statement

Pedagogical Considerations Statement

The target audience for this series of learning modules will be undergraduate level students in an introductory computer programming course. The topics of the series have to do with basic computer programming structures and patterns such as selection, logic, repetition, functions, arrays, and objects. This course material will be accompanied by a training module on developing Learner Resourcefulness as a lifelong learning habit. As the learning objectives for the programming portion have been defined, reviewed, approved, implemented, and improved in prior semesters, the resourcefulness training elements will be implemented and analyzed for their impacts on both lifelong learning skill and integration with student achievement. Throughout the unit, opportunities to be able to reach out to other students, tutors, instructors, professional contacts, and a variety of learning resources will be encouraged and a forum for sharing insights, seeking help, etc. will be implemented to support students in their learning journey.

APPENDIX L

Instructional Design Documents – Learning Environment Statement

Learning Environment Statement

	Topic	Analysis
1.0	What are the specific electronic hardware requirements for this project?	Students must have access to a modern laptop or desktop computer and a broadband internet connection to effectively utilize the learning management system and online video resources. [institution] must provide sufficient bandwidth and processor power to support all students utilizing the Learning Management System. A freely available video hosting service will be used.
2.0	What are the specific requirements in order to easily navigate the content materials (e.g., web–based items, 508-compliant resources, etc.)?	The LMS has been evaluated as 508 compliant, thus basic navigation of the LMS has already been addressed. All multi-media materials posted to the course space will have a text-based equivalent.
3.0	What are the specific software requirements needed for the learner to use the instructional materials?	Course materials will be delivered in World Wide Web compliant formats. Numerous free and commercial browser products are available for students to download and install in order to use course materials. Examples of free alternatives that should be linked in the course resource links include Mozilla Firefox, Google Chrome, Safari, and Internet Explorer.
4.0	What are the specific learner requirements for successful use of the materials (e.g., sufficient time to complete assignments in one session, alternative formats, etc.)?	As the resourcefulness training will be mostly complementary with the course material, the material and any related activities are intended to be completed within the same course defined time frames for assignments.
5.0	Include any statements that may have been used to support Item #13 in Task 07: Learner Influence Document (LID)**.**	Additional time and tutoring will be provided for learners with diagnosed learning disabilities as per university policy.

APPENDIX M

Instructional Design Documents – Delivery Options Statement

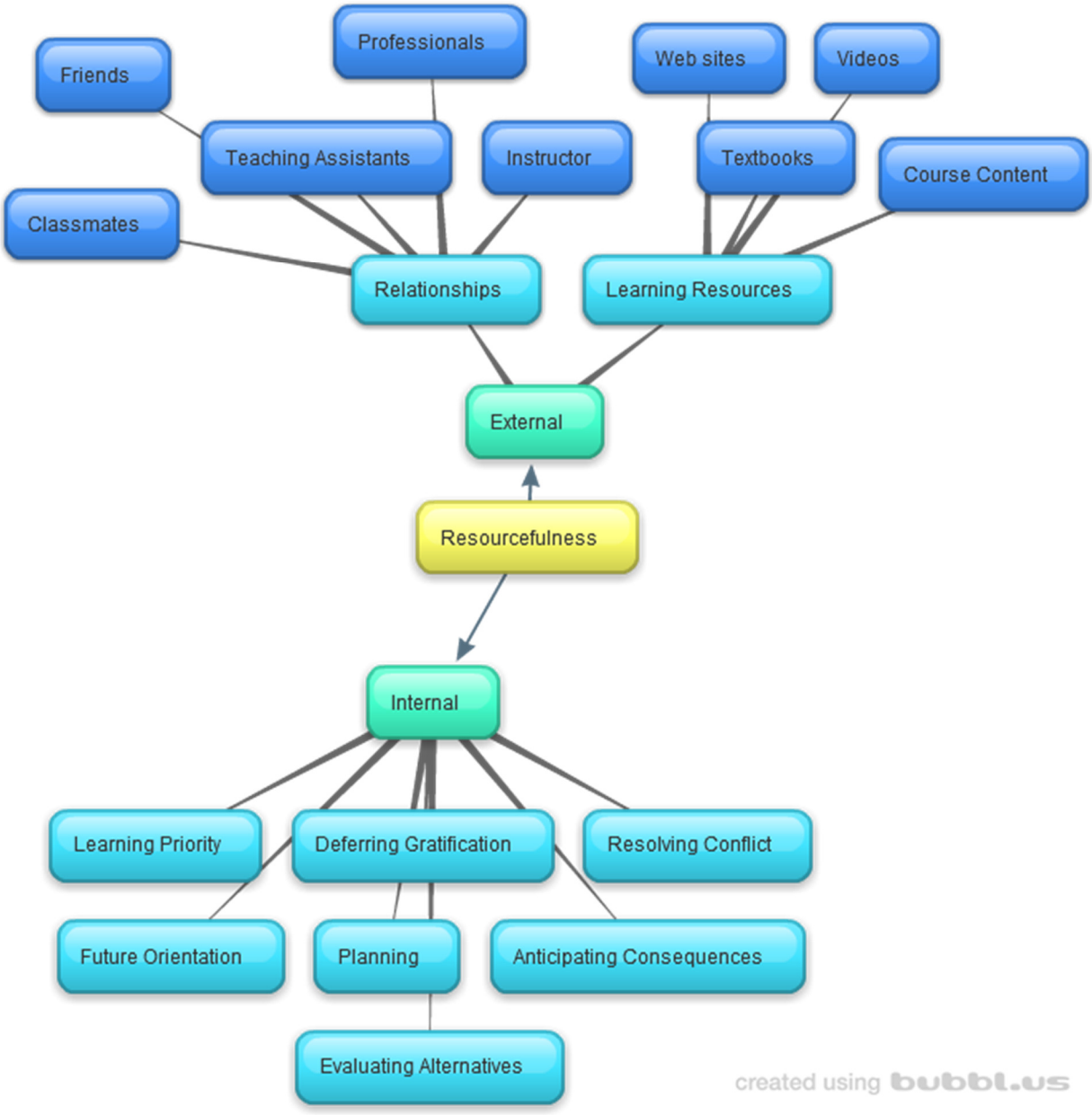
Delivery Options Statement

	Topic	Analysis
1.0	What is the delivery plan for the targeted content's assignments?	Prompts, resources, helps, and assignments will be posted on the course Learning Management System.
2.0	What is the delivery plan for the targeted content's activities?	Introduction will occur via a streaming video. Prompts, resources, helps, and assignments will be posted on the course Learning Management System.
3.0	What is the delivery plan for the targeted content's assessments?	Formative assessment will occur through assignments in LMS. Summative assessment will occur through the online learner autonomy profile (LAP) instrument.
4.0	What is the plan for learner self-directed materials (e.g. homework, out-of-class assignments)?	Course prompts, resources, and open-ended questions will be provided as examples and helps to stimulate self-directed practice and provide autonomy, reflection features along with the exercise of Learner Resourcefulness.
5.0	What is the plan for any remedial learning based on pre-test assessment feedback?	Helps on how to interpret the LAP results will be given to help aid students in understanding where they are deficient and how they can improve.
6.0	What is the plan for the availability of auxiliary formats for materials (e.g., printed, podcast, Wiki, blog, twitter feeds, etc.)?	Course materials will be delivered primarily in a text format. Students will have course discussion boards and teaching assistant support to help them deal with alternative format needs or any confusion.
7.0	What is the plan for student-to-instructor communication and interactions (e.g., face-to-face, synchronous, asynchronous, etc.)?	Students will have an asynchronous discussion board and a means for establishing synchronous student-to-instructor and student-to-teaching assistant appointments.

APPENDIX N

Resourcefulness Training Concept Map

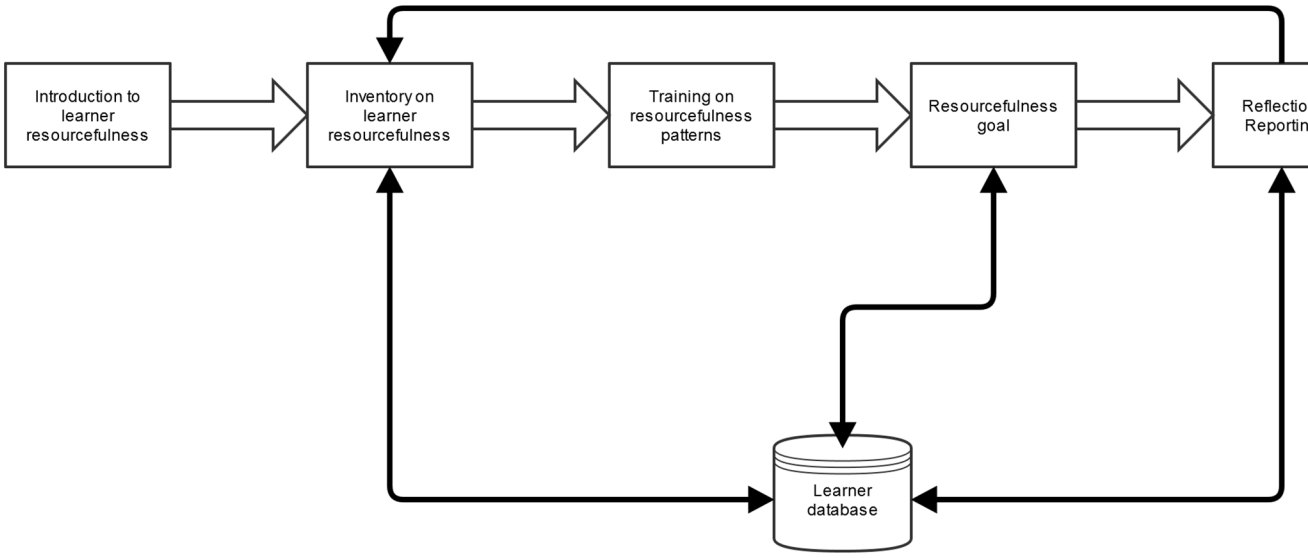
Resourcefulness Training Concept Map



APPENDIX O

Resourcefulness Training Flowchart

Resourcefulness Training Flowchart



APPENDIX P

Focus Group Introduction and Sample Questions

Focus Group Introduction and Sample Questions

Hello, my name is Kory Godfrey and I am representing both [institution] and Idaho State University as a researcher in Instructional Design. Thank you for taking the time to participate in this focus group supporting research on preparing students for lifelong learning in conjunction with Computer Programming.

You are a group of students who are currently enrolled in the [course code] Introduction to Programming class. You may have noticed that those in the class had a different experience. We would like to hear about your experience with the specific elements of the course such as the Learner Autonomy Profile, Learner Resourcefulness videos, goals and reporting methods, surveys, etc.

During this focus group I will ask questions to facilitate a conversation about your perceptions of the process, what you liked, didn't like, how it helped or inhibited your learning. Please keep in mind that there are no "right" or "wrong" answers to any of the questions asked. The purpose is to capture your experiences as a whole and identify the common elements and the differences in your experience. You will notice that the format of this interaction may seem rather odd. You may be used to an open discussion-style format for something like this. However, we will conduct this in an online forum with anonymous input following a format based on the Nominal Group Technique (see https://en.wikipedia.org/wiki/Nominal_group_technique) that has been shown to produce higher quality results from group input. I hope you will feel comfortable expressing your views and experiences in a candid and honest way.

Please note that this session will be recorded to ensure we adequately capture your ideas during the conversation. However, the comments from the focus group will remain confidential and your name will not be attached to any comments you make. I as the researcher and possibly my advisor at Idaho State University will be the only people that hear the actual recordings, which will be destroyed once the study is completed and the results are ready for publication.

Do you have any questions before we begin?

(See Vaughn, Schumm, and Sinagub, 1996)

Example to explain the outline structure below:

1. Primary question
    a. Potential follow up questions

Potential Questions

1. What was the most valuable lesson, skill, or appreciation you gained from this course?

   a. Why did each of you sign up for the CIT 160 Intro to Programming course? (sample for test run of the process)
   b. How does this course fit into your everyday life, life goals, career goals, and/or degree program?
2. How did you do with developing lifelong learning habits in this course?
   a. How do feel that the course addressed the [institution] mission to prepare students to become lifelong learners… in this course?
   b. How did the development of Learner Resourcefulness affect your ability to learn the computer programming concepts and skills?
   c. Would you say the development of Learner Resourcefulness in this course had a positive or negative effect on your abilities as a resourceful learner? Why do you think it was <positive/negative>?
   d. How did the LAP survey affect your performance in other courses?
   e. How do you think it will affect your performance in other areas of your life (family, work, community, church, etc)?
3. How did the computer programming material affect the development of lifelong learning skills and habits such as Learner Resourcefulness?
   a. Would you say the programming course activities and materials had a positive or negative effect on your abilities as a resourceful learner?
   b. Why do you think it was a <positive/negative> relationship between the two?
4. Tell me about the differences between how you learn outside of the classroom versus inside the classroom…
   a. What learning habits do you feel like are your strongest?
   b. What learning habits do you wish you had?
5. Tell me about your experience with resourceful learning in connection with this course and other areas of your life over the last few weeks.
   a. How do you think these experiences with Learner Resourcefulness will affect you in the future such as in your everyday life, work settings, home environments, family/social/community involvement, etc?
6. Tell me about your experience with being involved in a research study in connection with this course?
   a. How did knowing this course was part of a research study affect you?
   b. What do you feel that you did differently in this course compared to other courses as a result of the research study elements of the course?
7. Some students received the Learner Autonomy Profile survey about mid-semester and at the end of the semester while others only did it at the end of the semester.
   a. For those of you who took it twice (mid-semester and at the end of the semester), how did that impact 1) your performance in the course and 2) the development of lifelong learning habits?
   b. For those of you who took it once (at the end of the semester only), how did that impact 1) your performance in the course and 2) the development of lifelong learning habits?

APPENDIX Q

Research Question One: ANCOVA Results on Learner Resourcefulness Raw Scores

Research Question One: ANCOVA Results on Learner Resourcefulness Raw Scores

SPSS Settings:

- Analyze > General Linear Model > Univariate
- Dependent Variable: Resourcefulness_Posttest_Raw
- Fixed Factors: Treatment, LAP_Pretest
- Covariate: PretestScore

Between-Subjects Factors

		N
Treatment	No	41
	Yes	24
LAP_Pretest	No	35
	Yes	30

Descriptive Statistics

Dependent Variable: Resourcefulness_Posttest_Raw

Treatment	LAP_Pretest	Mean	Std. Deviation	N
No	No	134.3289	16.86755	19
	Yes	150.9091	18.59796	22
	Total	143.2256	19.48556	41
Yes	No	139.2031	31.37332	16
	Yes	139.4063	28.12438	8
	Total	139.2708	29.70973	24
Total	No	136.5571	24.30921	35
	Yes	147.8417	21.63704	30
	Total	141.7654	23.62652	65

Tests of Between-Subjects Effects

Dependent Variable: Resourcefulness_Posttest_Raw

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3845.974[a]	4	961.494	1.810	.139
Intercept	441260.803	1	441260.803	830.488	.000
PretestScore	806.334	1	806.334	1.518	.223
Treatment	152.040	1	152.040	.286	.595
LAP_Pretest	1355.980	1	1355.980	2.552	.115
Treatment * LAP_Pretest	786.582	1	786.582	1.480	.228
Error	31879.635	60	531.327		
Total	1342058.188	65			
Corrected Total	35725.610	64			

a. R Squared = .108 (Adjusted R Squared = .048)

APPENDIX R

Research Question One: ANCOVA Results on Learner Resourcefulness Stanine Scores

Research Question One: ANCOVA Results on Learner Resourcefulness Stanine Scores

SPSS Settings:

- Analyze > General Linear Model > Univariate
- Dependent Variable: Resourcefulness_Posttest_Stanine
- Fixed Factors: Treatment, LAP_Pretest
- Covariate: PretestScore

Between-Subjects Factors

		N
Treatment	No	41
	Yes	24
LAP_Pretest	No	35
	Yes	30

Descriptive Statistics

Dependent Variable: Resourcefulness_Posttest_Stanine

Treatment	LAP_Pretest	Mean	Std. Deviation	N
No	No	3.53	1.712	19
	Yes	5.45	2.176	22
	Total	4.56	2.180	41
Yes	No	4.31	2.651	16
	Yes	4.25	2.765	8
	Total	4.29	2.629	24
Total	No	3.89	2.193	35
	Yes	5.13	2.360	30
	Total	4.46	2.339	65

Tests of Between-Subjects Effects

Dependent Variable: Resourcefulness_Posttest_Stanine

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	44.486[a]	4	11.121	2.183	.082
Intercept	382.735	1	382.735	75.128	.000
PretestScore	5.461	1	5.461	1.072	.305
Treatment	.603	1	.603	.118	.732
LAP_Pretest	15.331	1	15.331	3.009	.088
Treatment * LAP_Pretest	12.296	1	12.296	2.414	.126
Error	305.668	60	5.094		
Total	1644.000	65			
Corrected Total	350.154	64			

a. R Squared = .127 (Adjusted R Squared = .069)

APPENDIX S

Research Question Two: ANOVA on Main Effects for Groups A and B

T-Test

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
FinalScore	A	27	77.67	17.153	3.301
	B	29	78.97	19.022	3.532

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
FinalScore	Equal variances assumed	.012	.913	-.268	54	.790	-1.299	4.853	-11.028	8.430
	Equal variances not assumed			-.269	53.950	.789	-1.299	4.835	-10.992	8.394

APPENDIX T

Question Two: ANOVA on Main Effects for Groups C and D

T-Test

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
FinalScore	C	25	82.16	14.812	2.962
	D	27	81.56	16.867	3.246

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
FinalScore	Equal variances assumed	1.497	.227	.137	50	.892	.604	4.417	-8.267	9.476
	Equal variances not assumed			.138	49.869	.891	.604	4.395	-8.223	9.432

APPENDIX U

Research Question Two: Stouffer's Z (Test I)

Stouffer's z

$z_{meta} = \sum_i z_{pi}/\sqrt{k}$

or

$z_{meta} = (z_{p1} + z_{p2})/\sqrt{2}$

Test E

$p = .417$ **or** $z = -0.210$

Test H

$p = .892$ **or** $z = 1.237$

Result

$z_{meta} = (-0.210 + 1.237)/\sqrt{2}$

$z_{meta} = 1.027/\sqrt{2}$

$z_{meta} = 0.726$ **or** $p = .726$

See Braver & Braver, 1988, p.152

APPENDIX V

Compiled Focus Group and Interview Responses

Compiled Focus Group and Interview Responses

How do you feel that you did in this course (learning programming)?	How do you feel like you did with developing lifelong learning habits in relation to this course?	How did the computer programming material affect your ability to develop lifelong learning skills and habits?
I worked really hard and spent about 7 hours a week studying.	Very well.	I have started to think about how programs I use work.
I feel that I performed good.	I feel that I got great take away from the course.	I feel that it benefited my lifelong learning and it helped me learn effective problem solving.
I felt like I did well until the end. At the end of the course, I felt rushed.	I would have liked to talk more about real world application rather than just the skillset	None
Very well	Not so well	It came really easily to me, so I didn't spend much time or effort studying
Above average compared to other courses	Very good	It helped me a lot.
Above average compared to other courses, less than 6 hours per week, consistent throughout	I think I did fine	Allowed me to make some complicated tasks simpler.
I feel like I did well. I tried and I got help every week to try and understand everything.	Excellent	It helped me to realize that in order for me to make it I have to always work hard, no shortcuts.
Excellent	It wasn't necessarily required for me to take this course so taking it to learn more about computers and how they function was working towards lifelong learning for me. My aim was to understand a variety of topics. Also, the LAP survey and the goals that came with it helped me to set goals and realize what goals are important.	not much

Very well	It helped a little but I already knew most of the learning goals	It helped me to learn more but the class was difficult.
Above average compared to other courses, less than 6 hours per week, consistent throughout	fine; i wasn't actively trying to do that but I'm sure I did because learning helps you keep learning...	it helped me practice learning
Above average compared to other courses, more than 9 hours per week, better at the beginning, consistent throughout	Because of the deadlines, I knew that I needed to read and have a rough draft of my assigned program blocked out by Tuesday. No putting things off!	I believe that my ability to focus and use logic increased
Above average compared to other courses	Very good	It helped me a lot.
Above average, less than 6 hours per week, consistent throughout	It helped me to look to outside sources and constantly learn more about programming.	It has affected my ability by helping me to program for future applications.
Above average compared to other courses, more than 9 hours per week, consistent throughout	I have discovered through this course that it is a lot easier to passionately learn about something that I am genuinely interested in. This will help me remember to choose things that I am passionate about, but also pursue other interests that might not seem to grab me right away (like this CIT class was).	On some of the skills learned in this class I really had to work hard to make things click and stick. It has reinforced that idea that you can learn and do anything if you put forth the required effort.

I did well once I got a tutor. That just worked much better for me.	I think it [the Treatment videos] only affected me a tiny bit. I'd think about it for a short time after I took the survey, but some kind of reminders or follow up would help keep it more fresh and help me make progress. [After watching a video and setting a goal] For the next 5 to 20 minutes I would remember the goal and try to apply it well. After that, it faded and didn't stick with me.	I had a tutor. He would go over everything. I need a lot of explanation. I like to be able to stop and ask questions, but can't do that in a regular classroom setting. Smaller groups makes it easier.
I did okay. It wasn't for my major, so I really had to try hard to think in a different mode.	Didn't really impact me in the course so much, more impact in daily life, seemed to apply to life more than what we were studying. Reporting back each week gave a great way of reminding of what we saw and learning.	I had to be in a certain mindset to figure it out. If I wasn't feeling it I couldn't get it figured out. If I focused too much on English that week, I couldn't get in the right mindset to complete it.
I'm not a fan of programming, so the course was hard, but I think I did well. I got a good grade in the end.	The movies were pretty inspiring. I never thought about how them that way.	With programming you have to be thorough with with. One little problem prevents everything from working. I was a little more thorough because of that. It was interesting to see what happens behind the screen.
Very well. This course just came really easy to me, which I needed last semester with everything else I was juggling.	Because of everything I have going on in life right now, I'm really working on time management. I know if I use my time well I'll be able to learn and do whatever I need to, it's just challenging to be able to do it all.	The class was just easy for me. I don't know if it is because I've done things like it before or if that is just how I think, but this was just a really easy class for me and I didn't have to work at it as much as others.

Pretty good. It wasn't for my major, and the material was pretty dry for me. I think I did pretty good learning it.	Impact was the same in this course and others... More so on the more difficult courses. It helped give me a little bit of inspiration and break up what else was going on in the CIT 160 with some perspective on why I'm learning. It [lifelong learning] didn't have to do specifically with the CIT 160 course so it related more to learning in general. It was probably less on the CIT 160 course than it did on other courses. CIT 160 was an easier course.	I have a lot of prior programming experience. This was similar to what I've done before. I was interested in HTML5 and JavaScript. I wanted to go more in depth. I used that to unlock other opportunities for me. I don't know why I hadn't searched out those subjects on my own. A structured environment like this course is a more effective way than picking things up piecemeal. I'd like to pick up a class here and there even if I don't need it for academics.
I did well in the course. I was able to have the feelings of success. I think this was built on the smaller projects. It was a great class and i wish C++ was organized the same way.	I think that I did well developing lifelong learning habits this semester. I was able to stay positive and productive while juggling my kids and church. I was able to feel a new excitement for learning as I applied myself	Having to learn a new language really stretched me and I was able to learn how to be better resourceful and create better habits to be able to be successful in it. I was able to have a better attitude and keep my end goal in mind for the semester and for my degree.

Very well. I'm more of a hands on, seeing it kind of person. Most of my life has been that way. Show me and then I can do it. There have only a few times when I could do it from the book.	Everyone has a different way they can learn, like from the lectures, I need to find the ways that I can learn	I took [another programming class] at the same time. I started to get the two classes mixed up because I was taking both at the same time. [the other class] was better. [In this major] you have to deal with a lot of stupid people. Your programs need to be robust.
It was an easier class. That helps. It always helps when I'm positive about it, it's easier to do well and be more positive about it.	low in the course, but significant for myself since I have a goal to learn everything that I can that is practical to me.	It was an easier class, when I'm positive about it, it's easier to do well and be more positive about it. It helped me go over and above what was expected and for the exams, helped me recognize what I don't know and work on it.
I think I did quite well. I got a good grade in the class.	Overall, it helped me realize that I can make goals and think about how to do it and practice at it. MacGyver video helped me realize I could look for new ways of doing things. I liked the reflection processes of looking back at what I was doing and thinking about how I could do better.	For my major, learned a skill that I didn't have before. Something I can use for web design.

I think I did pretty good. Programming did not always come easy to me and [the instructor] gave us problems that stretched us to thinking outside of the box.	I think it impacted it in a good way. There were questions that made me think about what I am learning in class and how I can apply the things I was learning in class to how I could become a better student in general.	I think I did pretty good. Programming did not always come easy to me and [the instructor] gave us problems that stretched us to thinking outside of the box. Dedication and percistance were probably the most crucial life long learning habbits I gained. What I had to learn is to stick with it. I could take a break and then come back later but what had to be done had to be done so I had to sit down and just think and pound it out until I came to the right answer. I didn't always get the right answer and I needed some help some times but just keeping at it taught me dedication and percistance.

How did the lifelong learning elements of the course (such as the LAP survey) affect your ability to learn programming?	**How did knowing this course was part of a research study affect you?**	**How accurate do you think the results from the Learner Autonomy Profile were in reflecting your lifelong learning habits and abilities?**	**Any other comments or feedback that you would like to provide?**
No response.	No.	Survey results underestimated my habits and ability	
The elements of the course helped to learn programming because I had a goal to look forward to.	It did not affect me, I try my best in all classes I do.	Survey results were accurate	
I don't really understand the question, but the survey didn't really affect me	It didn't really.	Survey results were accurate	
I was not hindered by them	Not at all	Survey results underestimated my habits and ability	
Not much.	It didn't affect me.	Survey results underestimated my habits and ability	It requires time. If you put enough time into it, it will be easy to learn it.
It reminded me of those values	It didn't really.	Survey results were accurate	Take the time to learn the material before you move on to the next.
didnt effect my learning.	It motivated me to always participate because it will be applied in helping other students to learn more effectively in the future.	Survey results were accurate	I feel it should be embedded in all other courses, it should be a continuous thing not just in CIT 160.
It helped me set goals and learn what priorities I have. However, it didn't make the class too much easier on me.	it was added work I had to remember to do	Survey results were accurate	Setting goals with the assignments is good. It would probably help if you get a tutor or an extra textbook you can mark up because the online text isn't super helpful.

It put things in perspective for me as such it helped me to even work with others unlike at first when I worked alone and this improved my grade	It didn't really.	Survey results were accurate	most of the time the videos would not play.
very minimally	very minimally	Survey results underestimated my habits and ability	Have [my instructor] teach them. He is the master!
No affect	No affect	Survey results were accurate	I had more problems with the math than with the programming. I liked it best when we had two weeks to understand a principle and practice with a program. I liked the discussion group and gain alot of good information from the class discussion groups (where more people where involved.)
Not much.	None	Survey results underestimated my habits and ability	
It kept me focused on the course.	It didn't	Survey results underestimated my habits and ability	Make it fun, which was done.
The LAP survey really helped me to reflect on my approach to learning, how I do or don't make learning a priority, and how I can improve on my approach to learning. I realized that if I want to truly succeed in my education (and learning even after school) I need to prioritize and not let myself get distracted by other things. That is probably my biggest challenge, just getting distracted by my kids, my calling, my husband, etc., and need to make an intentional plan for how to deal with balancing everything.	No. I thought about it whenever there was a task associated with it, but otherwise I was so engaged in the class I never really thought about it.	Survey results were accurate	This is something that someone could preach to me all day long, but until I have a good experience with it, or decide myself to make this a priority, I'm not sure what else could have improved my experience. I feel like in this class I kind of caught a fire for learning more about programming, but I'll be honest, I'm not exactly sure where it came from. I definitely think my instructor had a lot to do with it, but committing myself and working really hard contributed to it as well.

The [LAP] survey seemed too long to answer more truthfully and been more accurate. After about 40 I didn't want to read it anymore.	Didn't really affect or change my habits.	Not a fan of online surveys, better interaction from one-on-one conversation	I don't think they would listen to me anyway. I would remind students to be accurate, you are helping these guys out with the research
The biggest challenge was accountability - following through with the goals. I liked the motivation to get me through the week.	I didn't even think about it.	I always have a hypothetical of what I think I'm like. It was interesting to see that to compare to what I thought. To know where I stand. It's always good look for improvement.	I'm a big believer in setting short term goals to better yourself. Not just with learning, but with meeting new people as well.
Good motivation, but not too pushy. Helped me understand new perspectives.	It didn't affect me. There was once or twice where I tried to keep at it [the Treatment] since I knew it was for a study, but I don't think I did anything different in the course because of it.	I honestly didn't even look at the results. The survey was pretty long.	Planning. I'm planning for a wedding. Planning for those short term things and expectations for yourself. I can work on the accountability part. I usually do this on Sundays due to the sacrament and all that. I try to focus on what I can do better in the coming week.
I was so bad at doing this. I'm sorry. I really wish I could have done more with it, but I just have too many things going on in my life right now.	I wanted to help out with the study at the beginning of the semester, but then I just couldn't keep up with it.	I didn't do it, so I couldn't answer that.	I think failure and struggling help me learn best - having to come back and ask why. Many times it is in priorities. Am I putting the most important things first and using my time wisely?

Sociology/religious toned component that didn't seem to have much to do with the technical concepts that I was learning. That seemed good since the topics were dry and impersonal. This seemed an interesting component with it. Reminded me of what I see in the school district where I work. I fancied myself a lifelong learner before starting all that. It's opened my mind to ways of being a lifelong learner that I wouldn't have considered before. It has widened my palate a little more.	I don't think it affected me. I've been in studies before and I just do what I'm going to do anyway.	Probably pretty accurate. This makes one reflect on the purpose of education especially after being away for a while. Helped remind me of my goals rather than being in the routine. Not much bearing on me. Most of the changes occurred just as a result of reading the prompts.	I really liked what you had done. Motivating someone beyond your interaction with them is a difficult thing to do. You are making something that can stay in someone's mind for the rest of their life. I'm not sure what else I would do. Exposing in a variety of ways. Tying it into the gospel and into family were all there. I'm not sure what I would do differently. I tended to do activities that were predefined on the page just because it was easier to glom onto one of those ideas because of time. I think if I came up with the idea through introspection I might hang onto the idea longer. Maybe present the open option first so they are encouraged to think it through first... then show the other options after they've had a minute to think it through.
It did help me in my other courses. I had a new perspective as to the importance of learning, even in non major classes.As I perserevered and learned about lifelong learning a little more, I found myself feeling the need to learn more than, "just enough to get by" I wanted to make sure I was really learning the ins and outs of the language to better my learning over all.	None	I don't know. I guess they were fine.	I enjoyed the experience, the safety net of an instructor willing to help and a student forum where others might have similar hurdles to jump over gave me opportunities to research for them to help answer their question. It was a great place of learning.I felt more empowered by using other scorces than simply the book. I felt lile a mixture of discernment from the internet and reading the book gave me a more complete understanding.

It was just a survey. I did it just to be nice and help you with your research study. I didn't have the mindset that I was trying to improve myself. I put it in the back of my mind. That was my fault. I stopped doing it because I was more focused on working on my own work and balance that with being sociable	It had no effect	I just got home from a mission. It seemed like the same kinds of things that your mission president told you to do. One thing I remember was removing distractions. I try to focus on that. It probably helped me a little bit there. I did try to work on that, but that was about it. I'm sorry I didn't finish it.	I think we all need to be better learners - setting priorities, wanting to do it, my mission taught me quite a bit of that such as budgeting, time management, setting goals, find ways to get it done that sort of thing.
helped me create a paradigm, I like self help books, I viewed this similarly where it gave me a paradigm to think about lifelong learning. I liked trying to identify my resources to make the most of the situation. This helped me identify all the components that go into lifelong learning. It helped me recognize how stressors such as family life can get in the way of learning.	It didn't affect me.	I don't know.	In courses that I'm upset with or not interested in such as religion or outside of my major, I have a much more difficult time learning. I would imagine a key to success is to help students have a positive experience in areas where they are unfamiliar with the positive sides of the subject.
Eliminating distractions, set a reminder for myself - set a sticky note on the wall, better progress there. Eliminating distractions helped me focus better because I shut out Facebook and Pinterest. I was able to focus, learn better, and remember.	I didn't notice specifically	People have to want to make those kinds of changes. There were weeks that I listened to it as I multitasked. Having the option available was a good reminder.	[If I was a tutor] I would like to have lots of resources available such as articles, videos, meeting with students. I think having lots of options helps.

The LAP helped me to realize that I needed to learn things not just for what was in front of me now but for life long learning. I really need to learn things now and really learn them not just do the work to pass the class because I know that these principles that are taught are going to be applied later in my life. I think this is what the LAP made me realize.	I don't know. I don't think it made any difference to me. I still worked hard in the class.	It was pretty good. It just helped me think through how I was doing.	A suggestion that I would make is to incorporate how the concepts that we learend in class could be applied to a life long learning atmosphere. I believe that we learn as much as we want to and when we don't want to then the learning stops. If we were taught in class how to make this learning extend to the rest of our lives so that we can be motivated to continually learn, I think that would help other students.

APPENDIX W

T-test of Online Versus Face-to-Face Delivery Formats on Learner Autonomy

T-Test

Group Statistics

	Format	N	Mean	Std. Deviation	Std. Error Mean
LAP_Posttest_Raw	Online	18	483.1250	69.03661	16.27208
	In class	49	461.0867	65.94102	9.42015

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
LAP_Posttest_Raw	Equal variances assumed	.098	.755	1.198	65	.235	22.03827	18.40131	-14.71168	58.78821
	Equal variances not assumed			1.172	29.145	.251	22.03827	18.80212	-16.40809	60.48463

T-Test

Group Statistics

	Format	N	Mean	Std. Deviation	Std. Error Mean
LAP_Posttest_Stanine	Online	18	5.11	2.471	.582
	In class	49	4.31	2.311	.330

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
LAP_Posttest_Stanine	Equal variances assumed	.524	.472	1.241	65	.219	.805	.649	-.491	2.101
	Equal variances not assumed			1.202	28.638	.239	.805	.669	-.565	2.175

APPENDIX X

T-test Comparisons of Online Versus Face-to-Face Delivery Formats on Resourcefulness

T-Test

Group Statistics

	Format	N	Mean	Std. Deviation	Std. Error Mean
Resourcefulness_Posttest_Raw	Online	18	151.1944	26.67638	6.28768
	In class	49	137.2500	21.71993	3.10285

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Resourcefulness_Posttest_Raw	Equal variances assumed	.768	.384	2.188	65	.032	13.94444	6.37197	1.21875	26.67014
	Equal variances not assumed			1.989	25.747	.057	13.94444	7.01161	-.47501	28.36390

T-Test

Group Statistics

	Format	N	Mean	Std. Deviation	Std. Error Mean
Resourcefulness_Posttest_Stanine	Online	18	5.33	2.544	.600
	In class	49	4.04	2.198	.314

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Resourcefulness_Posttest_Stanine	Equal variances assumed	.516	.475	2.045	65	.045	1.293	.632	.030	2.555
	Equal variances not assumed			1.910	26.889	.067	1.293	.677	-.096	2.682