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Influence of Self-Assessment Scripts on Self-Regulated Learning and Students' Performance in a Multimedia Environment

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Abstract

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by

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MA, Interamerican University of Puerto Rico, 1997

BS, Sacred Heart University, Puerto Rico, 1993

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Multimedia learning may be more effective than text-only methods. Researchers have not examined the effects of metacognitive strategies on self-regulated learning (SR) within multimedia learning environments (MLE). The purpose of this quasi-experimental study was to examine potential differences in learning and SR skills between students who use a script as a self-assessment tool and students who do not, while creating a conceptual map. The cognitive-affective theory of learning with media was used to frame the study. The sample included 87 secondary school students from a public school in Puerto Rico, enrolled in 11th and 12th grade English courses. Control and treatment groups completed a questionnaire to measure group difference in goal orientations at the beginning of the study. A *t*-test results indicated differences between the groups in disposition, and motivation variables. SR was measured before and after the implementation process through questionnaires. A 1-way ANOVA showed no differences in SR skills used by both groups. Results showed no differences in learning in both groups. A multiple regression was run to predict learning from group, disposition, and motivation variables. Results indicated the variable group as the most significant predicting the learning process. These results may encourage more research on SR strategies including a focus on different academic content, self-assessment instruments, and variables related to SR in MLE. These findings can contribute to positive social change in guiding teachers, students, and multimedia designers to develop MLE and SR processes to enhance student performance and obtain better academic results.

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Dedication

For my son and my daughter. Thanks for your support and understanding.

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I would like to thank Dr. Arome, Dr. Foshay and Dr. Pederson for helping me through this process and for their continuous motivation, support, and insight. I would also like to thank my best friend for her emotional support and help with the editing process of my dissertation. These people are responsible for the most part of my success. I will forever be grateful for the time and shared knowledge.

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Chapter 1: Introduction to the Study

Learning in a multimedia-learning environment can be a way for students to acquire new concepts in multiple audiovisual formats such as videos, static and motion pictures, oral narratives, and written texts (Mayer, 2009). However, theoretical and empirical questions arise when considering the employment of the learning process using multimedia (Mayer, 2014a). Although prior researchers explored the learning effects of multimedia formats that incorporate visual or verbal content to enhance learning, this study addressed whether learners can choose optimal self-regulated strategies while working in multimedia environments when learning a new concept.

As the application of multimedia technology in colleges and universities in Puerto Rico has increased in the last years, teachers and students have assumed the effectiveness of multimedia. However, in a literature review on metacognition and multimedia, Azevedo and Aleven (2013) recognized the role of metacognition in learning. Metacognition helps students recognize their personal cognitive style and their relationship with multimedia learning via self-regulated learning. The more students control their monitoring and cognitive strategies while working in multimedia environments, the more multimedia environments will ease their learning (Azevedo & Aleven, 2013).

I examined the effect of scripts in learning improvement when used as a self-assessment strategy. More specifically, I investigated how this technique promotes the use of metacognitive strategies in the multimedia learning environment. Self-assessment

is a key element of the self-regulation process and is required for students who have self-regulated their learning with success (Panadero, Alonso-Tapia, & Huertas, 2012). Because of the limited research related to the self-regulation process in multimedia learning, this study contributed to the literature regarding the metacognition process in multimedia environments. Also, the findings provided a theoretical and practical basis for improving the use of multimedia technology among secondary schools in Puerto Rico.

In Chapter 1, I briefly summarize the literature and describe the gap in this field of study. I also present the research problem, purpose of the study, research questions and hypotheses, and the theoretical framework. This chapter also includes the nature of the study, definitions of terms, assumptions, scope and delimitations, limitations, and significance.

Background

Acquiring knowledge is a complex process in which new learning situations occur all the time. However, when college students try to learn, and fail to achieve academic success, it is often because they lack skills to self-regulate their learning (Zimmerman, 2008). Students should develop self-regulated learning to have the necessary skills to perform successfully in school (Panadero et al., 2012; Winne, 2011). Greene and Azevedo (2007), and Zimmerman (2008) agreed that self-assessment is a key component of the three phases of self-regulation: planning, execution, and self-reflection. For self-regulation and learning to occur, self-assessment is necessary (Peters & Kinsantas, 2010; Taras, 2010).

The self-regulation process is cyclical because its three phases (planning, execution, and self-reflection) interact with each other. When students engage in the planning process and subsequently in the execution, reflection, and evaluation phase, they perform a self-evaluation process throughout the entire cycle (Alonso-Tapia, Huertas, & Panadero, 2010). This implies that students are constantly undergoing a self-evaluation process. Students evaluate time consumption, learning strategies, emotions involved in the task, progress, and other components of learning. Self-assessment is important in promoting self-regulation (Panadero & Alonso-Tapia, 2013; Puustinen & Pulkkinen, 2001).

Problem Statement

Clark and Mayer (2016), and Mayer and Moreno (2002a) defined multimedia learning environments as those that emphasize the use of educational material with pictures and words, to help students understand knowledge content and to enhance their performance. Studies indicated that multimedia learning can be more effective than text-only methods (Burket & Azevedo, 2012). However, multimedia-learning research has been focused on the principles of design and its effects of learning (Crooks, Cheon, Inan, Ari, & Flores, 2012; Kalyuga, 2012; Schüler, Scheiter, Rummer & Gerjets, 2012), such as the modality and redundancy principles (Schüler, Scheiter, & Gerjets, 2013). In spite of this, Mayer and Moreno (2002b) argued that not all multimedia messages are effective in promoting constructivist learning principles when the learners employ their cognitive learning process. Cognitive learning aids such as signals (Scheiter & Eitel, 2015),

intentions (Stalbovs, Scheiter, & Gerjets, 2015), scaffolds, prompts, questions, and reflections (John & Lazonder, 2014) are designed to improve students' learning in multimedia contexts (Mayer & Moreno, 2002b). These cognitive aids are designed to support the cognitive processes related to the task of learning, and those involved with self-regulated skills such as the selection, organization, transformation, and integration of information (Kombartzky, Ploetzner, Schlag, & Metz, 2010). Experimental studies in multimedia environments like the ones outlined in the research of Kombartzky et al. (2010), Ruf and Ploetzner (2014), and Ploetzner and Schlag (2013) showed that students' knowledge acquisition improved when they incorporated cognitive learning aids such as the use of worksheets with instructions, to complete the task. On the other hand, Delen, Liew, and Willson (2014) researched the effects of students' performance on a new video learning environment by scaffolding students' self-regulation skills in online learning. Although several studies addressed the effectiveness of self-regulation on the learning process (Dignath, Buettner, & Langfeldt, 2008; Zimmerman & Schunk, 2011), few studies have addressed the effect of self-assessment techniques to enhance self-regulation when learners work in a multimedia environment.

Self-regulated learning can be effective if students are able to monitor and evaluate their own performance and identify and select the appropriate task for the development of their learning strategies. However, studies indicated that students, particularly those without prior knowledge of the learning tasks, are not very effective in self-evaluation or in the selection of tasks (Kostons, van Gog, & Paas, 2012). Garello and

Rinaudo (2013) emphasized that self-regulation is not innate, but self-regulatory behavior can be enriched or inhibited by the circumstances surrounding the person and situation. Complex activities, for instance, require the use of self-regulation skills, supports and external scaffolding, cues, and modeling to inform the student about the most important points for an activity (Cruz & Abreu, 2014; Larreamendy, 2011; Panadero & Alonso-Tapia, 2013). Panadero and Alonso-Tapia (2013) stated that self-assessment is a key component of self-regulated learning, and the use of scripts as a strategy of self-assessment allows students to develop and use self-regulatory skills when performing learning activities. Results from previous studies showed that scripts promote learning (Alonso-Tapia, Huertas, & Panadero, 2010), and improve processes of self-regulation in the student (Kramarski & Dudai, 2009). Panadero, Alonso-Tapia and Huertas (2012) stated that more research is needed on learning situations and the effect of scripts on academic achievement.

It was important to investigate self-assessment and the self-regulated processes during multimedia learning, especially among students who lack prior knowledge. Researchers had overlooked the effects of using metacognitive strategies related with self-regulated learning within multimedia learning environments. The present study addressed this problem by analyzing the effects that the use of scripts, as a self-assessment strategy, has on promoting metacognitive strategies in a multimedia environment, to improve learning. The focus of this research was evaluating the effects of scripts as self-assessment strategies in multimedia environments, to promote self-

regulated learning by comparing self-regulation among a group who used scripts while working with multimedia learning and another group who did not.

Purpose of the Study

The purpose of this quasi-experimental study was to determine whether there exists a significant difference in student learning and self-regulated skills, between students who use a script as a self-assessment tool, and those who do not employ this technique when working in a multimedia environment.

Research Questions and Hypothesis

Literature in multimedia research showed that learning with pictures and words helps students understand knowledge content to enhance their performance. Many research studies showed that multimedia learning can be more effective than text-only learning (Burket & Azevedo, 2012). However, Mayer and Moreno (2002a) argued that not all multimedia messages are effective in promoting learning when students use cognitive processes involving self-regulated skills. Cognitive learning aids such as signals (Scheiter & Eitel, 2015), intentions (Stalbovs et al., 2015) scaffolds, prompts, questions, and reflections (John & Lazonder, 2014) are designed to improve students' learning in multimedia settings. Of all processes related to self-regulation, one of the most important is self-assessment, which is necessary for learning to take place (Panadero & Alonso-Tapia, 2013; Peters & Kitsantas, 2010). Self-assessment involves students evaluating their time management, use of learning strategies, and progress in the implementation of a task, as well as other aspects of the learning process (Alonso &

Panadero, 2010). Scripts, defined as structured questions on particular steps following the expert model to approach the task from start to finish, have positive effects when promoting self-regulation and learning (Alonso & Panadero, 2010). According to Panadero, Alonso-Tapia and Reche. (2013), using scripts in the learning process helps students assess whether, during a task performance, their processes are adequate to successfully complete it. The use of scripts enables students to self-assess their performance from start to finish. However, studies involving scripts have been mainly conducted within experimental settings, with only a few studies taking place in real settings (Kramarski & Michalsky, 2010).

This research objective was to analyze the effects of the self-assessment process on self-regulation when students work in multimedia contexts. The purpose of this study was to evaluate the effect of the use of scripts as a self-assessment strategy in students' learning, and to understand the use of self-regulated strategies within multimedia contexts. Moreover, I examined whether these strategies help improve learning. Also, I evaluated the effect of the self-assessment script on student learning outcomes. The following research questions (RQs) and hypotheses (*H*) were developed to guide the study:

RQ1: Does the use of a script as a strategy for self-assessment in multimedia learning affect students' learning?

$H_0$1: There is no significant difference or meaningful effect size in students' learning when comparing those who use a script as a strategy for self-assessment in a multimedia learning environment and those who do not.

H_a1: There is a significant difference and meaningful effect size in students' learning when comparing those who use a script as a strategy for self-assessment in a multimedia learning environment and those who do not.

RQ2: Is there a difference in self-regulation strategies used by students who incorporate scripts as a strategy for self-assessment in multimedia learning compared with students who do not?

$H_0$2: There is no significant difference and meaningful effect size in self-regulation strategies between students who use the script as a strategy for self-assessment in multimedia learning and students who do not.

H_a2: There is a significant difference and meaningful effect size in self-regulation strategies between students who use the script as a strategy for self-assessment in multimedia learning and students who do not.

Theoretical Framework for the Study

The theoretical framework for this study was Moreno and Mayer's (2007) cognitive-affective theory of learning with media (CATLM). Moreno and Mayer explained that for effective learning to take place in a multimedia environment, technology requires the activation of prior knowledge by the learner. This is important to

guide the cognitive processes, which should incorporate instructional methods embedded in the learning environment.

Also, this study included theoretically based principles about self-assessment and self-regulation. A recent review by Panadero et al. (2013) of the main theories of self-regulation indicated that self-evaluation is an essential process in self-regulated learning. Empirical findings supported the validity of self-assessment and self-regulation connections (Korneeva, Zherebnenko, Mukhamedzyanova, Moskalenko, & Gorelikova, 2016; Panadero, Jonsson, & Strijbos, 2016; Panadero et al. 2013), specifically self-assessment, considered to be a process that improves overall learning.

Results of a study about self-assessment and learning in English as a foreign language writing skill showed that self-assessment influenced students' writing skills performance positively (Javaherbakhsh, 2010). Javaherbakhsh (2010) suggested that self-assessment as a means of alternative assessment, helps students become autonomous learners and apply efficient techniques for their own learning, which represents a development of student skills related with self-regulated learning. In another quasi-experimental study, Khodadadi and Khodabakhshzade (2012) found that students who worked with portfolios and wrote self-assessment tasks regularly scored higher than students who only completed their essays as writing assignments. In addition, the results showed that students improved their sense of independence when performing writing activities, which are also considered to promote self-regulated learning skills (Khodadadi & Khodabakhshzade, 2012).

In the context of learning improvement and self-regulated skills development, Panadero et al. (2012) found that self-assessment tools promote students' use of higher levels of self-regulated skills. Also, self-assessment tools have a positive effect on learning, promoting students to develop mastery of a task (Kramarski & Michalsky, 2010; Panadero et al., 2012). Authors like Zimmerman (2008) and Green and Azevedo (2007) argue that self-regulated skills are important to achieve success in higher education. However, it is require that teachers promote the development of metacognitive activities, working with teaching strategies for students' self-monitoring the development of a specific task (Cazan, 2013).

Cognitive Theory of Multimedia Learning

According to Mayer (2009), multimedia learning involves learning with words and images. Knowledge acquisition can therefore be achieved through textbooks that combine illustrations and text, animation and narration in computer-based lessons, and presentations with voice and words that contain graphics, which can be found in both online and face-to-face lessons. According to this theory, learning is constructed by integrating knowledge to working memory. Integration occurs when the student constructs a mental representation of a sound into a visual image. In this sense, the working memory, which is of limited capacity, is responsible for the selection, organization, and integration of words and pictures (Mayer, 2014b). Therefore, activating prior knowledge is required for students to understand and perceive the new concept (Moreno, 2004; Mayer & Moreno, 2002b).

Mayer and Moreno (2002a) based the cognitive theory of multimedia learning on dual coding theory and cognitive load theory, with assumptions that people construct their knowledge and produce meaningful learning when the information is relevant, coherent, and integrated with prior knowledge. The knowledge gained through visual and verbal representations is produced by students' processes of reasoning, intuition, and perception. The fundamental principles of this theory are related to active learning. Active learning implies that the student participates in coordinated cognitive processes that allow him or her to acquire new information (Mayer, 2014a).

Cognitive-Affective Theory of Learning With Media

The cognitive-affective theory of learning with media (CATLM) is based on the cognitive and affective processes in multimedia learning. The theory arises from the theoretical frameworks of cognitive theory of multimedia learning integrating both learning motivational and emotional aspects. Besides cognitive assumptions on which Mayer (2014a) based the cognitive theory of multimedia learning, the CATLM is complemented by three new principles: the affective mediation principle, which states that motivation can increase or decrease the use of cognitive processes (Park, Knörzer, Plass, & Brünken, 2015; Park, Moreno, Seufert, & Brünken, 2011); the metacognitive mediation principle in which metacognitive factors are involved in learning to regulate cognitive and affective processes; and differences in students' prior knowledge (Moreno, 2004).

Self-Regulation

Self-regulation is a cyclical process through which students take command of their own learning, stemming from task identification, planning, monitoring, and evaluating. In addition, students identify strategies to address the difficulties and emotions that arise, as well as assess their performance and identify the causes of the results of their learning process. For the student who is self-regulated, this entails a process to achieve personal educational goals (Zimmerman, 2000). Theories of self-regulation indicate that students who self-regulate their learning also self-assess their cognitive, emotional, motivational, and behavioral processes in progress, as they are aware of what they need to modify or control to achieve learning (Zimmerman & Schunk, 2011).

Self-Assessment

Self-assessment is the student's ability to judge his or her achievement of a particular task. Students describe what steps are required, how their own work differs from others', and what they can do to improve it. This is a process in which students compare their execution and performance, the amount of learning involved in the process, and how to perform a better task in the future (Lan, 1988).

The type and degree of students' self-assessment is conditioned by their objectives and how they perceive their effectiveness. The type can be affected by the teacher's instructions and expectations. The degree can be improved when students follow established criteria while performing a task. These evaluation criteria are

standards for students to evaluate the implementation and the learning result of the task (Panadero et al., 2013). This standard should be presented clearly during the learning process to provide students with a clear expectation about what to do. Although students must internalize the evaluation criteria set by their teacher, this internalization process is difficult, making necessary an external support (Andrade & Du, 2005). Scripts contain evaluation criteria that provide the support students need to perform a self-assessment process using self-regulatory skills (Panadero et al., 2013).

Nature of the Study

The nature of this study was quantitative. Two groups of students from secondary schools in Puerto Rico were examined through a quasi-experimental non-equivalent pretest/posttest treatment design as identified by Campbell and Stanley (1963). As Creswell (2009) argued, this method allows interventions in a real-life setting and does not require random selection.

The treatment was a self-assessment learning script (Appendix F, F-1) I developed using the expert model of design. Students in the treatment group used the script during four weeks of treatment to develop a conceptual map portfolio in their regular classroom setting, while students in the control group created this portfolio without the aid of the script. This skill was selected because conceptual mapping is a learning strategy that increases students' performance and enhances their learning achievement (Sun & Chen, 2016). Conceptual mapping is also an effective technique to

assess students' meaningful learning (Redford, Thiede, Wiley, & Griffin, 2012; Stoica, Moraru, & Miron, 2011; Taşkin, Pepe, Taşkin, Gevat, & Taşkin, 2011).

The creation of these conceptual maps was a part of the class grade, but the rubric scoring that resulted in the dependent variable of learning did not count for or against any student's grade and students were so informed. The student grades were or were not influenced by the implementation of scripts. However, the implementation of these scripts was the teachers' prerogative, consistent with similar rollout procedures for similar curricular changes used when students (in the control group) have minimal risk of being disadvantaged. In addition, study results did not show a statistical difference between control and treatment groups. Students in the control group did not receive the same (script) treatment after the data collection.

Treatment and control groups both studied a 6-week English unit, and at the end of each week, all students watched a PowerPoint presentation in the form of a video summary of the week's content. Students in the control group prepared four conceptual maps of the summaries without using the script. Students in the treatment group prepared four conceptual maps using the script.

For the first research question, the independent variable was the use vs. non-use of a self-assessment script. The dependent variable was learning, measured using a rubric for the conceptual maps (Appendix G). All students completed this conceptual map during their class as part of the normal curriculum and were graded as usual using the course's conceptual map rubric. However, because the script implementation did not

affect class grades and could not disadvantage students in the control group, the implementation rubric's scores were not disclosed to the students.

For the second research question, the independent variable was the use vs. non-use of a self-assessment script, and the dependent variables were self-regulation strategies students employed, both in the treatment and control groups (measured by two questionnaires) and scored as numbers generated by each questionnaire. A pretest/posttest design was used, as shown in Figure 1.

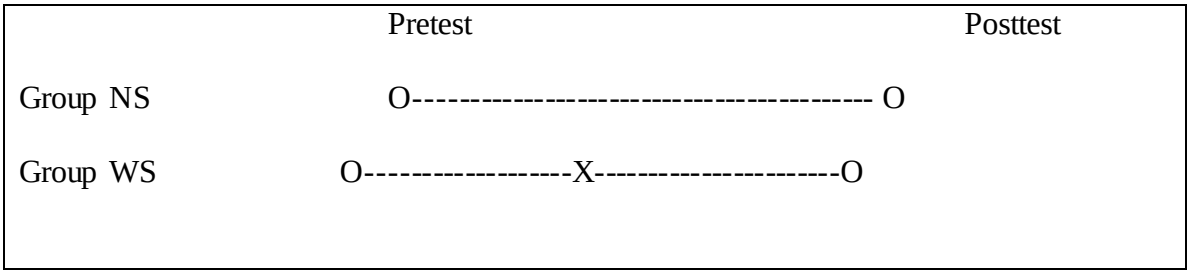

Figure 1. Quasi-experimental design.

To measure the dependent variable for Research Question 2 at pre- and posttest, I used two self-regulated learning questionnaires. As suggested by Samuelstuen and Bråten (2007), a combination of instruments is better than one tool in a pre- and posttest to assess self-regulated learning. These questionnaires were the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & McKeachie, 1991; Appendix C, C-1), and the Emotion and Motivation Self-Regulation Questionnaire (EMSR-Q in English and Cuestionario de Mensajes Autoregulatorios (CMA in Spanish) (Alonso-Tapia, Panadero, & Diaz, 2014) (Appendix A). The full MSLQ includes 81 reactive self-reports to measure the use of learning and motivation strategies among students. The

instrument incorporates aspects of self-regulated learning in a metacognitive self-subscale, which emphasizes the relationship between motivation and cognition (Schunk & Zimmerman, 2008; Zimmerman & Schunk, 1989). However, in the present study students only responded to questions on one scale, the MSLQ, which consisted of 12 items yielding a single numeric score.

The EMSR-Q (English) or CMA (Spanish), (Alonso-Tapia et al., 2014) contains 20 items that include five types of general self-messages or mental verbalizations through which students self-regulate (adequately or not) the positive and negative emotions that can favor or interfere with their learning activities, as well as the motivation itself. The questionnaire yields a single numeric score. Both the EMSR-Q/CMA and MSLQ questionnaires were used to assess the self-regulation dependent variable as pre- and posttest, respectively.

In addition, to further identify group similarities on pretest, students in both groups completed the Questionnaire of Learning Motivation and Expectancies (LEMEX) (MAPEX in Spanish) (Alonso-Tapia, Huertas, & Ruiz, 2010) (Appendix D, D1). This questionnaire was used for assessing goal orientations to ensure sampled students within the treatment and control groups were similar in their academic orientations at the beginning of the treatment period. If the results reflected a difference, goal orientation was included as a moderator variable.

As described above, this study was designed to measure effects on students' learning by comparing the performance of a control group and a treatment group, when

using and not using a script as a self-assessment instrument, while working on the development of four weekly conceptual maps prepared after a summary presented in a video presentation and scored with a rubric. To further establish that the treatment and control groups were comparable, students in both groups prepared two conceptual maps before the treatment group was introduced to the script. This was done after they watched a summary of the content of the first two weeks through a multimedia presentation without using the script. The second conceptual map of each student was scored using the rubric as pretest. I found no differences in the means scores at pretest. The Week 2 pretest rubric scores were not used as a moderator variable. Therefore, the actual treatment period for use of the scripts was four weeks. Although the completion of this assignment was a graded procedure, rubric scores used as the pretest variable and posttest variable in the study did not influence students' class grades in any way. Because the script implementation rubric did not affect class grades, and therefore could not disadvantage students in the control group, the implementation rubric's scores were not disclosed to the students.

Because the scores for Week 2 and Week 6 were comparable, the score of the second conceptual map, rated with the rubric, was subtracted from the score of the 6-week conceptual map for each student. A rubric for the Week 6 conceptual map was used as a posttest of achievement to assess learning gain. Each conceptual map developed by students and graded using the rubric was not a part of the students' class grades. As a

normal part of the classroom curriculum, each conceptual map reflected the development process that students learned when working with multimedia, with or without the script.

To minimize the threats to, and improve the reliability of the implementation, the teacher was trained about the development of conceptual maps and the implementation of the script (see Kershner et al., 2014). In the implementation process, students from both groups worked at a regular time in the classroom, which was the time exposed to treatment and used to treat fidelity. I used direct observation to assess correct use of the script. I also observed and reviewed the class time procedure using a checklist (Appendix I) and teacher's recall about the use of the script during the conceptual map work hours in the experimental group. The results of the Motivation and Disposition scales of the LEMEX (MAPEX) questionnaire were included as moderating variables. However, the results of the second conceptual map developed by the students were not included because they did not show differences between the treatment and control groups before the script implementation.

Two weeks before starting the study, the English teacher received training about the development of a conceptual map using the multimedia video. She also received training on how students used the script in the classroom to develop the conceptual map.

Figure 2 shows the research timeline for data collection.

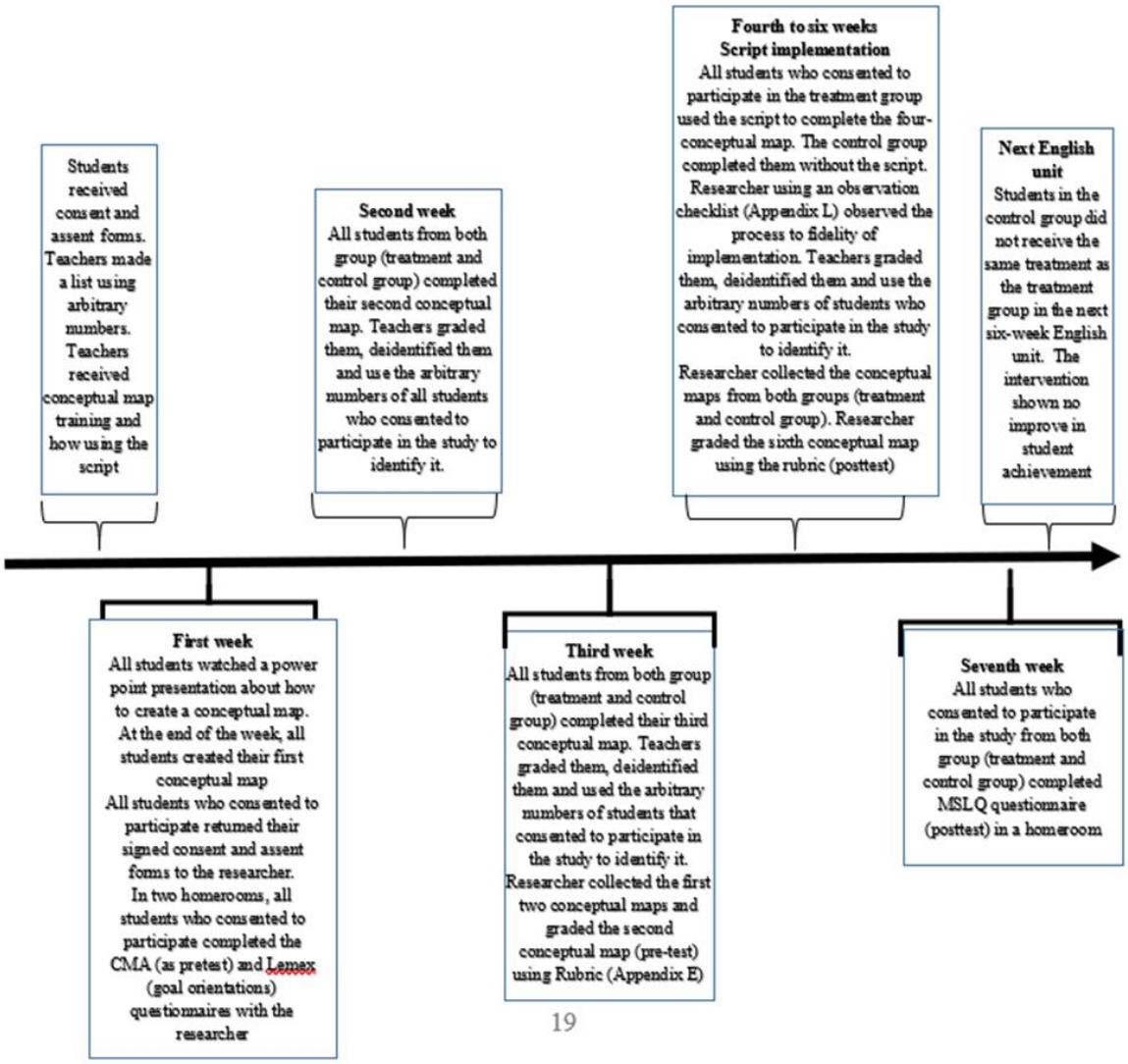

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Figure 2 Research timeline.

Setting and Sampling Strategy

A convenience sample was necessary for this study because I had access and proximity to the groups, but a limited degree of randomized assignment was possible. Intact groups were randomly assigned to those who used scripts and those who did not. Nevertheless, if some students from each group chose not to participate, students of both treatment and control were within the same class group.

Convenience sampling was suitable for various reasons. The purpose of the study was to obtain information about the learning process in a real-life setting using a particular method. The research questions involved the response about a teaching technique in which data from characteristics of the sample were not used and were not expected to have implications on the outcome. This reduced the likelihood that the research was biased in terms of sample characteristics. In addition, convenience sampling was an inexpensive and efficient method to conduct the study. However, one of the consequences of convenience sampling was that the results could not be generalized beyond the sample.

To further support the selection of this research sample using a non-probabilistic design for convenience, I used G*Power to determine that the sample should consist of 88 students (Nuzzo, 2016). The full power calculation process is explained in detail in Chapter 3. I required 100 students to ensure sufficient data for the study. This allowed for attrition and missing data, taking into consideration students who withdrew from the study.

The population was secondary students from a public school in Puerto Rico. The size of the population was approximately 450 students. The sample for this study included students from one 11th grade group and three 12th grade groups. In each class sampled, 25 to 30 students were enrolled, and I recruited four classes to ensure that the minimum sample would be obtained. Intact class groups were randomly assigned to script groups and non-script groups, and students knew about the study after being enrolled in the course.

To ensure privacy, students' homeroom teachers marked their consent and assent forms with a unique identifier, and used this same number to label all questionnaires and conceptual maps. During data collection, I used these labels to match the study data for use in the regression analysis, and to ensure that only consenting participants were included in the study. Only students with completed consent forms were included in the final data set.

If a student was enrolled in a course and chose not to participate, even after completing all the documents, he or she could still be part of the process of developing the conceptual map while using the script or not. The student did not have to leave the group, but the difference was that he or she did not answer the questionnaires, and the results of his or her Week 2 and Week 6 conceptual map rubric were not included in the data analysis. The decision to remove the student from the sample after he or she has voluntarily opted out was necessary because the skill to be learned was a normal part of the course. The only difference was in the use of a script as a self-assessment instrument

to develop the conceptual map, which was what this study aimed to measure. The use of the script did not result in higher learning achievement. The script was not provided to the control group after the final data collection.

Definitions

Learning improvement (conceptual maps): According to Mayer (2009), learning signifies a change in knowledge ascribable to experience, and its process involves three parts: a change in the learner, a change in the learner knowledge, and a change in the learner's experience in a learning environment that occurs within a learner's cognitive system. Although the change cannot be observed directly, "it could be inferred in a performance change on a test" (Mayer, 2009, p. 60). Mayer asserted that rather than adding knowledge, this process involves the reorganization and integration of new knowledge to prior knowledge. This is closely related to "metacognitive strategies required to form connections between information that is received and existing knowledge" (Mayer, 2009, p. 67). For this study, learning improvement was defined as the difference between the pretest and posttest scores, and was operationalized as the differences between the rubric-graded performance in the creation of the conceptual maps developed between students in control and treatment groups. Students created six conceptual maps in six weeks. The Week 2 conceptual map was graded with a rubric as the pretest, and the Week 6 conceptual map was graded with the rubric as the posttest to evaluate the impact of the intervention. Rubric scores used in the study were separate

from the typical class activities, and students did not see these rubric scores or receive grades for them that applied to their class grades in any way.

Multimedia: Using words and visual material that can be static or animated images (Mayer, 2014). Multimedia also "refers to the sequential or simultaneous use of a variety of media formats in a given presentation or self-study program" (Heinich, Molenda, Russell, & Smaldino, 2002, p. 242). For the purpose of this study, multimedia consisted of a PowerPoint presentation with imagery and texts, and a video presentation with imagery and voices.

Scripts: Specific steps structured according to the expert model of performing a task from beginning to end, including the assessment criteria presented as questions, which the students must answer themselves (Alonso-Tapia & Panadero, 2010). Scripts were formulated as questions indicating the steps that students had to follow, thereby centering students' attention on the learning process.

Self-assessment: A comparison between "one's own execution process and performance with criteria to make us become aware of what has been done to change it if necessary, and to learn from it in order to perform a better task in the future" (Panadero et al., 2012).

Self-regulated learning: An activity composed of cyclical processes such as setting goals, self-evaluation, motivation, emotion, and the use of metacognitive thoughts to achieve a learning objective. These processes can be learned, developed, or activated using learning strategies (Panadero & Alonso-Tapia, 2014).

Moderator Variables

Goal Orientation

According to Debicki, Kellermanns, Barnett, Pearson, and Pearson (2016), learning goal orientation refers to the preference of individuals to strive to achieve learning objectives in achievement situations. Payne, Youngcourt, and Beaubien (2007) considered goal orientation a stable characteristic that affects learning and performance in different domains. Goal orientation seems to lead students to take responsibility with the persistence and perseverance necessary, to achieve the objectives defined by their motivational orientation. This in turn has a positive effect on the use of strategies to control and direct their mental processes for the self-regulation of learning (Alonso-Tapia & Panadero, 2010). In the current study, the LEMEX questionnaire was used to identify group similarities on the pretest, to enhance internal validity. Groups showed differences in two goal orientations scales: Motivation and Disposition. These were included as moderator variables.

Teacher Effect

Teacher effect is related to teachers' behaviors or characteristics that influence the learning process and students' achievement (Bacher-Hicks, 2015). The type of instruction provided by the English teacher could have made a difference for the four groups in the study. This variable could have influenced the effect of the independent variable on the dependent variable.

Implementation

Implementation refers to a process called intervention "that may examine strategies that are specifically designed to improve variables that are defined as implementation outcomes" (Peters, Adam, Alonge, Agyepong, & Tran, 2013). In this study, I asked two teachers to model the script used as the treatment. If teachers did not implement the script as designed, the treatment might not have been implemented as intended. To mitigate this threat, I used an observation checklist (Appendix I) to ensure the fidelity of implementation. Each English teacher implemented the script as intended. Therefore, the fidelity of implementation was not a moderator variable.

Assumptions

Internal validity threats to the study included students not completing the self-regulation questionnaires honestly. To minimize this threat, two questionnaires were used to assess self-regulated strategies and to encourage independence and honesty in the evaluation process. A second validity threat was students not using the script properly by following the instructions. To mitigate this threat, I observed the class in both the control and treatment groups.

I assumed fidelity of implementation of instruction on the conceptual map development skill. To mitigate the fidelity threat, I provided teachers and students with equal training in the process. This equivalence was also verified during classroom observations. Students in the classes were trained to complete two prior conceptual maps before the intervention.

I also assumed that there was no treatment contamination between groups, and that there was no attrition from either group because of other assignments or tasks related to the course content. The data obtained when using a script to develop a conceptual map signaled attrition. Lastly, I assumed that learning outcome measures were valid and reliable.

Delimitations

This study was conducted secondary public school located in a rural area of Puerto Rico. The students did not represent all secondary students because they were in a rural area. The results may have been different if a different sample of students had been used. The results were not generalizable to other populations of students. Video multimedia is a teaching strategy that helps improve learning, but not all types of multimedia were used in this study. This study was limited to a multimedia learning environment that incorporated the use of a script as a self-assessment strategy.

Limitations

The first limitation of this study was convenience sampling. This prevented me from generalizing results to a broader group of students. In addition, participants were selected from one secondary public school. As a result, sample size was a limitation. Another limitation was the short time assigned for the treatment, which was the 6-week unit content.

Another limitation was that although the study design was quasi-experimental, non-equivalent pretest/posttest, the data used to measure the students' achievement were

obtained through the application of a conceptual map. The study addressed the difference between a pretest and posttest in the creation of a specific type of evaluation. Consequently, the results could not be generalized to other students' evaluation activities.

The pretest/posttest control group design has been widely employed in education with the purpose of evaluating the effectiveness of different types of teaching aids (Campbell & Stanley, 1963; Chambers, 2004; Fraenkel & Wallen, 2010). However, this design includes multiple threats to internal validity. These threats include selection bias, history effect, maturation effect, mortality effect, testing, and instrumentation. In addition, because of the nature of the study, I could not directly compare pretest and posttest knowledge gain. All of these threats could have affected the study, thereby weakening the results (Campbell & Stanley, 1963). Finally, self-regulation questionnaires have not been used among Puerto Rican populations. There have been few studies involving Hispanic people in which questionnaires have been employed as experimental tools.

Significance

This study was important because it addressed the limited research on multimedia learning among secondary level students, and the use of multimedia presentations as a teaching and learning strategy (Liu, 2012; Sankey, Birch, & Gardiner, 2011). Although some researchers emphasized the effectiveness of multimedia learning, it was important to examine the learners' metacognitive processes involved when performing in this environment, and how self-assessment may improve this process. This study contributed

to the literature on the importance of self-assessment and self-regulation skills in multimedia environments. This study added a new perspective related to the development and use of multimedia in educational environments.

Moreover, the public school system in which this study was conducted benefited from the results. This research provided a possible alternative through which every student could complete a task and develop skills to create a conceptual map, by following the same structure and using cognitive processes to enhance learning skills. These self-regulated learning skills may help students perform better in other courses (Zimmerman & Schunk, 2011) by increasing retention within school system.

Lastly, this research provided insights regarding the use of educational technology. Results provided information to teachers, instructional designers, and technology educators about students' cognitive processes employed to facilitate learning to enhance student performance when working in multimedia environments. Development of self-assessment and self-regulated skills may improve students' ability to solve problems in society with the power of learning and self-regulated skills (Zimmerman & Schunk, 2011).

Summary

In this chapter, I introduced the study by noting that self-regulated learning was important to achieve academic success, and that the self-evaluation process is an intrinsic component of the overall process. Although researchers have studied the processes of self-regulation and self-evaluation with the aim of promoting academic improvement,

little research has addressed the effectiveness of self-assessment tools such as scripts, in the promotion of self-regulating skills, and academic performance of students working in multimedia contexts. This quasi-experimental study was conducted to analyze the effect of scripts as tools for self-assessment in self-regulating skills used by students in multimedia environments. The results of this study may influence teachers and education professionals who use multimedia as a teaching tool. Also, the findings may help instructional designers develop multimedia with educational purposes. Finally, the present research added valid and reliable information to the field of multimedia learning. In Chapter 2, I review the literature on how researchers have investigated self-regulated learning, the use of scripts as self-assessment instruments, and multimedia learning as educational material for academic improvement. This literature review also shows the gap in the research that was addressed this study.

Chapter 2: Literature Review

Students are increasingly using digital materials such as e-books, open educational resources, e-learning environments, and educational applications that include multimedia elements (Yap, Neo, & Neo, 2016). Also, each day more teachers and professors are using multimedia presentations to deliver course content. Multimedia refers to the use of text and images, and has been found to be more beneficial than learning from text alone (Clark & Mayer, 2016). Learning with multimedia can be challenging because it involves the integration of both text and images in a consistent mental image (Mayer, 2014). However, integration does not always occur (Richter, Scheiter, & Eitel, 2016). In addition, the design of multimedia materials is not entirely precise in how much students learn, but it is important to include how students can process information efficiently (Kombartzky et al., 2010). The purpose of this study was to analyze the effect of scripts as a self-assessment strategy, to improve learning and to promote the use of self-regulated learning in a multimedia environment. This chapter presents a review of prevailing cognitive theories on the effects of scripts on learning in multimedia environments.

Multimodal learning, as defined in the cognitive multimedia learning theory, involves the application of textual and pictorial representations to improve knowledge acquisition (Mayer, 2001; Moreno & Mayer, 2007). The cognitive-affective theory of learning with multimedia advances this theory by introducing two components: metacognitive and motivational factors. According to Pintrich (2003), motivational

factors mediate the learning process by either increasing or reducing cognitive engagement. Metacognition enables the learner to conduct a personalized assessment of his or her cognition of the presented content. This level is the primary linkage between cognitive theories and self-regulation instruction methods. The self-assessment conducted through metacognition enables the learner to formulate a suitable future study plan, which improves learning (Azevedo, Feyzi-Behnagh, Duffy, Harley, & Trevors, 2012).

This chapter presents a review of the literature related to this study. First, I discuss the use of scripts in research. Second, I present self-assessment as a pedagogic strategy to promote self-regulated learning. After this, I define self-regulated learning and review literature regarding this concept. Third, I review research related to multimedia learning and students' performance in multimedia environments. Fourth, I examine the importance of the self-assessment and self-regulation processes in the multimedia environment. Finally, I review the theoretical framework for this study.

Self-Assessment Scripts

Panadero et al. (2012) defined scripts as structured questions related to particular steps that follow the expert model to approach the task from start to finish. The script's purpose is to analyze the steps students should follow throughout a task. Panadero et al. used a pedagogical definition for this tool because using scripts to analyze the outcome does not allow students to focus on all aspects involved in the process of self-assessment of students' understanding and task completion.

Scripts, considered as a scaffold (Fisher, HirshPasek, Newcombe, & Golinkoff, 2013), can develop in different ways including explicit and implicit messages included in the learning content or graphics embedded in collaborative or printed documents. These can present the sequence to perform individual and group tasks, as well as collaborative tasks. Scripts can also show messages as scaffolding, propositions, or questions. Furthermore, scripts offer directions or suggestions to complete a task from start to finish (Kollar et al., 2014; Noroozi, Biemans, Weinberger, Mulderand, & Chizari, 2013; Tsovaltzi, Judele, Puhl & Weinberger, 2015).

Research on scripts has focused mainly on computer supported collaborative learning environments (Karakostas & Demetriadis, 2014; Noroozi et al., 2013; Papadopoulos, Demetriadis, & Weinberger, 2013; Stegmann, Wecker, Weinberger, & Fischer, 2012). These scripts enhance the quality of argumentation, knowledge construction, and problem-solving activities, and foster collaboration and quality in the interaction (Popov, Biemans, Brinkman, Kuznetsov, & Mulder, 2013). Experimental research addressing use of different kinds of scripts showed that the scripts enhance the quality of students' individual participation and knowledge construction (Panadero et al., 2012). This happens while also improving the relationship between the activities process, and promoting the collaboration process.

In collaborative environments, Noroozi et al. (2013) defined a script as "specific instructions that stipulate the type and sequence of collaborative learning activities to help group members accomplish tasks" (p. 12). In their experimental study, Noroozi et al.

developed a transactive memory script with the intention of understanding how this may improve the transactive memory system in online collaborative settings. To develop this script, the researchers used the *transactivity* to mean the extent to which students build and relate their learning by referring to what their peers have said about learning. In that sense, the script helps students develop argumentative knowledge construction during the discourse to improve the particular content knowledge domain through the process of argumentation. These procedures allow the development of the transactive memory system that involves steps by which two or more people in a group establish a shared system for encoding, storage, and retrieval of information. In this process, each person is responsible for memorizing only part of the complete information. In collaborative work, each person knows who the expert in some field is and uses the information to create shared knowledge, to improve the integration processes of learning and decision-making through the group's communication.

In Noroozi et al.'s (2013) experimental study, 60 university students were assigned to different conditions in an online discussion board platform, with and without transactive memory scripts. The researchers used an ANOVA to compare the formal quality of individual arguments and argumentation sequence. The result showed that the formal quality of individual arguments was significantly greater for scripted learners compared to those obtained by unscripted learners, $F\ (1, 26) = 17.33$, $p < .01$ with no effect size reported. Findings indicated scripted learners' capacity to build more supported and limited claims when compared to unscripted learners. Moreover, the

results for script students regarding the formal quality of argumentation sequences were higher during discourse than for unscripted learners, F (1, 26) = 7.25, p < .05.

Aligned with these results, Stegmann, Wecker, Weinberger, and Fischer (2012) examined the influence "of an argumentative computer-supported collaboration script (with vs. without) on the formal quality of argumentation" (p. 309) in an online discussion forum. The effect size reported showed a significantly higher quality of argumentation in scripted conditions than in an unscripted situation, U = 14.5, p < .05, $R2$ = 0.20. This effect is consistent with a large effect size (d = 0.82) found in the quasi-experimental study of Scheuer, McLaren, Weinberger, and Niebuhr, (2013). Using a pretest-intervention-posttest design, Scheuer et al. (2013) found that undergraduate students in script condition improved the quality of online discussions' depth of elaboration, U = 7.50, p<.05. Similar to the Stegman et al. (2012), Noroozi et al. (2013), and Scheuer et al. (2013) findings, in a randomized controlled trial experiment with German university students, Tsovaltzi, Judele, Puhl, and Weinberger (2015) found a significant main effect, F (1, 77) = 4.7, p = .033, of the argumentation script on individual quality of argumentation when using Facebook as a platform for discussions. When taken together, these five high-quality studies show significant effect sizes for the use of scripting to improve argumentation quality, across a wide range of settings and samples.

Although previous experimental studies suggest that scripting enhanced the quality of individual arguments, researchers Popov, Biemans, Brinkman, Kuznetsov, and

Mulder (2013) recommend a different approach. Popov et al.'s study was a 2 × 2-factorial design study with 130 university students selected based on their cultural background determined as their country of origin at the beginning of the academic year. The researchers divided the students in dyads formed by two from the same country and two from different countries. Their research found that for an improvement in the quality of online discussion when students work in dyads, cultural similarities should be considered. A MANOVA analysis showed that no matter the script conditions, the same culture dyads produced a higher quality of online discussion than the mixed-culture dyads, $F(3, 59) = 2.86$, $p < .05$.

When addressing knowledge acquisition among learners by measuring the formal quality of individual arguments, experimental research with and without a script, in collaborative environments show different results. In Noroozi et al. (2013), an ANOVA results showed significant differences in the formal quality of the single argument between scripted and the unscripted group of learners $F(1, 26) = 17.33$, $p < .01$. Also, scripted learners reflected a greater knowledge acquisition on the formal quality of argumentation sequences, while unscripted learners obtained lower scores, which means there is a significant difference between both groups $F(1, 26) = 7.25$, $p < .05$. On the other hand, both scripted and non-scripted learners' scores were significantly different with regards to collaborative knowledge construction, $F(1, 26) = 8.82$, $p < .01$. Besides, results show an improvement in the quality of individual and group problem solution plans. Tsovalty et al. (2015) and Stegman et al. (2012) showed results consistent with

Noroozi et al.'s (2013) results. According to Tsovalty et al. (2015), the results showed a significant effect on argumentation quality between the pair of students that used the argumentation script than the couple who did not use it $F(1,77) = 4.7$, $p = .033$. Aligning with these results, Stegman et al. (2012), using a Mann–Whitney-U tests, showed that learners who used the scripts showed a significant increase in the quality of their argumentation at an individual level, $U = 14.5$, $p < .05$. At the group level, a *t* test showed similar results, $t(14) = -2.58$, $p < .05$. For both studies, however, using scripts did not foster individual learning gain. In sum, these studies show that scripts facilitated group knowledge transfer, but not individual knowledge transfer.

Related to the acquisition of mathematical argumentation skills, Kollar et al. (2014) conducted a study involving 101 beginning mathematics teachers divided into two groups, according to prior achievement. Participants were then randomly assigned to the four experimental conditions of a 2 X 2 –factorial design. The researchers compared the effect of a collaborative script and heuristic examples as scaffolding in a social - discursive component that measured students 'acquisition of knowledge about the sequence of an argumentation process. An ANCOVA analysis performed with a social-discursive quality as the dependent variable, and collaboration script vs. heuristic worked examples as independent variables. The statistics showed that the collaboration script led to significantly higher gains and moderate effect size $F(1,96) = 4.42$, $p = .04$, with an effect size of .42 than unstructured collaboration for students with prior knowledge.

In general terms, the results showed that both types of scaffolding produced no significant results, F (1, 96) = .03, p = .86, when students have no prior knowledge. However, their use reflected a significant difference in the development of argumentation skills in couples with previous knowledge F (1, 93) = 5.23, p = .02. When comparing collaboration scripts and unstructured collaboration, the results proved that the first led to greater gains. Moreover, when comparing heuristic worked examples with problem-solving techniques on posttest achievements, the results showed the former to be a decisive factor to take into consideration. However, these effects are not always found and seem to rely on different variables such as the extent and quality of the script structure and the duration of the intervention (Papadopoulos et al., 2013).

Nevertheless, few studies have focused on the use of scripts as scaffolds to analyze their effect on self-assessment and self-regulation skills. Also, little empirical evidence is available on their effectiveness in self-regulation skills, social forms of metacognitive regulation especially during collaborative problem solving on the web (Azevedo & Hadwin, 2005; Molenaar, Van Boxtel, & Sleegers, 2011; Raes, Schellens, De Wever, & Benoit, 2016).

Panadero et al. (2013) undertook a quasi-experimental study with 69 pre-service teachers where rubrics and scripts, as self-assessment strategy, were employed. The study aims to contrast the effect of both instruments in self-regulated skills and self-efficacy. Teachers enrolled in three-course classrooms of "new technologies applied to education". Each natural class was randomly assigned to one of three experimental conditions; 20 in

rubric condition, 20 in the script condition, and 29 in the control group. Each group received the instructions from the same professor assigned to the three groups on how to design multimedia material using PowerPoint and a Web Quest/Search Treasure. Immediately after, the professor modeled the exercise by using self-assessment tools designed for each group: Group A: rubrics, Group B: scripts; Group C: control. Each group then received the tools. During the 10-week course, students worked independently in the development of multimedia material and the web quest. Also, the teacher reminded the students that the scripts and rubrics contained all the criteria needed to design the content. Upon completion of the 10 weeks, students presented their work and were assessed using rubrics designed specifically for this study. Finally, the students completed the instruments of self-regulation, specific self-regulation, and self-efficacy questionnaires.

Although teachers preferred using the rubric, results reflected an opposite result in learners. Participants who used the scripts demonstrated more skills when using the self-regulated process than those who used the rubrics, $F\ (2, 64) = 5.37$; $p < .01$, showing that the effect of the rubric was a decrease in performance and self-regulatory process evasion.

These results, aligned with other research such as the studies conducted by Kramarski and Michalsky (2010), and Peters and Kitsantas (2010) where script and prompts aided students' performance, improved learning, and enhanced the use of the metacognitive process related with self-regulated skills. Both studies examined the

effects of a metacognitive prompts intervention as questions and checklist (Peters & Kitsantas, 2010) in participants' performance and the use of self-regulation skills.

Kramarski and Michalsky's (2010) research was a quasi-experimental, pre- and posttest design study whose population was a group of 95 pre-service high-school science teachers who worked in pairs. Teachers were divided into experimental and control groups and using the same two hypermedia environments, focused on implementing teaching and learning methods through Technological Pedagogical Content Knowledge (TPCK) activities. However, the experimental groups were exposed to four different metacognitive self-guided questions, while on the other hand, self-regulated learning prompts employed comprehension, connection, strategy, and reflection. The results using effect sizes (Cohen's d) for the pre- and posttest proved to be dissimilar within each group. Results showed that the experimental group used self-regulation components as cognition, metacognition, and motivation more effectively (1.07, 0.93, and 0.85, respectively) than the control group (0.40, 0.36, and 0.48, respectively) when pre- and post gains between groups were compared (Kramarski & Michalsky, 2010).

Self-regulation effects also were significant in a mixed method study by Peters and Kitsantas (2010) with 162 middle school science students. Using a pre- and posttest design, researchers incorporated self-monitoring questions and checklists, as a metacognitive prompt, in four experimental classes. When comparing with the comparison groups, the experimental group showed a better performance in "content knowledge F (1, 138) = 6.63, $p < .01$ and nature of science knowledge F (1, 162) = 36.6,

$p < .01$" (p. 39) than the comparison group. In the qualitative aspect study, findings revealed that students who used metacognitive prompts developed more sophisticated self-regulated learning skills than students in the comparison group.

Panadero et al. (2012) conducted another similar study on 120 secondary school students to measure the preferred method of self-assessment. The assessment between the best method of regulating self-efficiency learning and creation while comparing the use of rubrics and scripts, is one of the factors that is accentuated in the management of the arrangements for learning by the researchers. Panadero et al. (2012) employed thinking aloud protocols and questionnaires to assess the use of the scripts and rubrics in learning. From the analysis of the information through the ANOVA tests that were carried out, it was evident that the use of self-assessment scripts resulted in better performance rates when compared to the utilization of the rubrics. Additionally, the employment of both methods increased student self-assessment based on the learning outcomes of the study (Panadero et al., 2012).

Downing (2010) argues that the use of scripts is an effective way of shaping the behavior and habits of individuals. Based on the analysis in his study, the use of the self-assessment method proved to be helpful for maintaining the practices that have been chosen by the individual when learning. MacGregor (1993) supports the idea of employing self-learning scripts due to the fact they can be used as a method to stimulate students´ learning processes. According to the scores obtained when using the student

learning method, it is evident that the use of scripts is an important aspect of the learning process, which is also helpful for the management of the study methods by the students.

Although the studies above present positive results about the use of script as prompts or self-assessment instruments in self-regulation learning skills, some research find contrary results (Raes et al., 2016; Linn & Eylon, 2011; Strijbos & Weinberger, 2010). To investigate the effects of a collaboration scripts in regulatory process when students work collaboratively on a web-based project, Raes, Schellens, De Wever, and Benoit (2016) conducted a quasi-experimental study with 270 students working in pairs. The results showed no significant improvement with a small effect size (0.11, 0.08) between students' use socially shared a regulatory process with a collaborative script and without it.

Raisinghani (2013) evaluates the use of the self-assessment method when learning in the online education setting. According to the author, the use of scripts is an aspect that has affected the learning evaluation methods by the students. Moreover, the author argues that the utilization of the scripts has increased the incorporation of methods that were employed in the self-assessment aspect of the higher educational learning criteria. Additionally, Raisinghani (2013) points out that it is important for other techniques to be developed when evaluating students. Boud (2013) examined the effects of the learning methods using scripts in educational learning. The evaluation method through the use of factors based on students' performance showed that the use of scripts is also dependent

on students´ level of enhancement, as some of them may find it hard to use scripts instead of rubrics.

Comparison of Rubrics and Self-Assessment Scripts in Learning

The use of rubrics as a method for assessment is a popular concept. It is used to articulate the expectations of an assignment based on the listing of the assessment criterion that will be used to evaluate the work. Panadero and Jonsson (2013) argue that the use of rubrics in self-assessment is a technique that could be used to foster student learning. According to the authors, the use of rubrics is a way for teachers to enhance the alignment of student learning, based on the instructions given and the assessment that is expected from them. Ross (2006) argued that the use of self-assessment by instructors with students is an aspect that is based on the evaluation of the best learning criteria. Ross (2006) states in his research review about self-assessment that rubrics are useful if they include vocabulary and skills that are familiar to the student and focuses on skills that students perceive as important.

The support provided to student learning using rubrics has affected the levels of interaction based on the analysis that the students make on themselves. Panadero and Jonsson (2013) state that based on some studies regarding the use of rubrics, there can be adverse effects on the performance of students when employing this technique as a mechanism for assessment. Jonsson and Svingby (2007) stated that the student assessment method reflects an increase in test scores. After their empirical research on rubrics, the authors concluded that the use of rubrics is necessary for the management of

information sources, based on the analytical tools that have utilized to assess students. The empirical research conducted by Jonsson and Svingby (2007) was based on the use of 75 studies that regarded the use of rubrics to promote learning. The database search involved was intended to find out the effects of rubrics in the management of the student learning processes. The data reveals that the use of this technique was one of the most reliable scoring performance assessment tools when employed analytically concerning specific topics, and complemented with the use of examples. Moreover, the authors found that the use of rubrics did not foster valid judgment of the assessment performance and that this method has the potential of promoting student performance to improve the way in which instructions are given.

Research conducted by Andrade and Du (2005) focused on the use of rubrics by 14 undergraduate teacher education students for self-learning and assessment. In the study, the participants from the focus groups were instructed to incorporate rubrics to plan and assess their work, to guide them and later on, reflect on their performance before they presented their assignments. Through the use of the rubrics, the students mentioned that the method helped them focus on their studying based on the maximization of efforts on a particular topic. Andrade and Du (2005) add that students also noted that the use of rubrics helped them hand in higher quality assignments and scored better grades in school. The students also mentioned that the rubrics were helpful in knowing the factors that the instructors would assess while also aiding them in satisfying the demands of the teachers.

The popularity of rubrics in higher education is a factor that has been incorporated as a means to increase student performance based on the assessment criteria. Reddy and Andrade (2010) reviewed the incorporation of this technique as a way through which the students can be assessed at the post-secondary level of education. From the evaluation of the available studies on the use of rubrics, it can be noted that some of the instructors preferred other means for assessment. From the study, the researchers noted that the use of rubrics involves both positive and negative aspects, based on the opinions of the teachers and instructors. The research evaluated the use of this method in three studies, which showed the positive use of this mechanism in the first two experiments, while not in the third. The researchers explained that the contradiction between the first two studies with the third was because of the small sample size used it in the third study. Another factor was that students in the third study had access to the rubric immediately before the task they had to perform using it, while in the first two, students engaged with the rubric deeply before developing the task.

Reddy and Andrade (2010) also argue that the use of rubrics help to identify the need for improvement stemming from the perspectives of certain academics. The study reflected how the incorporation of this technique helped instructors evaluate students' performance, while also better assessing students as a way of getting them to know the areas they can improve on. The appropriateness and the language involved in the use of rubrics have fostered the incorporation of such methods, and have helped in the management of student interpretation, which has in turn aided in the improvement of the

student learning processes. However, from the research conducted, it was noted that the use of rubrics may not be a rigorous enough method to promote student self-learning.

Reddy (2007) analyzes the effects of the use of rubrics as a way to assess student performance. The researcher argues that the use of rubrics as a method of assessment has affected the way t educators deliver the intended messages to students. Based on the analysis of the literature collected by Reddy (2007), I may reach the conclusion that the use of rubrics may be considered as a way to enhance students' performance and promote learning, for it is a technique that a majority of educators have found to be effective. The use of rubrics based on the literature that has been collected by the researcher indicates that the assessment method helps in the development of the curriculum based on the evaluation of the study methods.

The use of self-assessment scripts, as mentioned before, is a method that has proven to be helpful when managing the learning criteria in the multimedia learning setting. Panadero, Alonso-Tapia, and Reche (2013) compare the use of scripts when assessing student learning criteria. In their study, they used 69 pre-service teachers to assess the most effective tool between rubrics and scripts with regards to the before mentioned. After the analysis process, results showed that students who used scripts had scored higher levels of learning and self-regulation when compared to those who employed other assessment methods such as control and rubrics. Additionally, the authors noted that the use of the rubrics decreased the performance and self-regulatory aspect of learning, as it reduces self-regulation by the students. However, based on the

study, the results also showed that students preferred the use of rubrics when compared to the use of scripts.

Yukiko (2006) points out that the use of various student assessment methods may present new challenges in the development of learning methods. According to the author, the use of the assessment tools, when applied in a technological environment, creates diversity in the assessment criteria. The aspect that Yukiko (2006) points out is that the use of technology in the classroom has increased student attention with regards to the assessment that is being measured on them. Race (2014) adds that the use of scripts is an important addition to the toolkit required by the lecturer in student performance evaluation. Furthermore, the author states that the use of the various mechanisms in self-assessment is a factor that needs to be developed to ensure the maximization of the resources required for the evaluation of the students.

Although scripts, prompts, and metacognitive questions help students to improve their performance and their use of self-regulated skills, in a literature review by Panadero and Johnson (2013), they analyze the rubric employed in research as a formative purpose. With this, they meant to say that their research applied empirical data and studies where the rubrics were used for developmental purposes. After this selection process, the researchers selected 21 studies to complete the experiment. Their findings suggest that rubrics can be beneficial for student learning if different factors such as gender and cognitive activities are taken into consideration, and are used in various ways related to the learning content purpose. According to their findings, the use of rubrics for formative

purposes improves student performance due to the following reasons: “increasing transparency, reducing anxiety, aiding the feedback process, improving student self-efficacy, or supporting student self-regulation” (Panadero & Johnson, 2013, p.138). However, the authors concluded that the use of rubrics could outperform student learning when used with metacognitive activities, for instance, the use self-assessment instruments.

Self-Regulated Learning

Self-regulation (SR) is a cyclical process through which students take the lead in their learning, beginning with the identification of the task, planning, monitoring, and finally, evaluation. Also, students identify strategies to address the difficulties and emotions that arise in this process, assess their performance, and determine the cause of the results of the learning process (Panadero & Alonso-Tapia, 2014). For the student who is self-regulated, this involves a process to achieve personal and educational goals (Zimmerman, 2000). Theories of self-regulation indicate that students who self-regulated their learning, self-assess their cognitive, emotional, motivational, and behavioral processes in progress as they are aware of what they need to modify or control to achieve learning (Zimmerman & Schunk, 2011).

Zimmerman (2000) identifies three phases or stages while using self-regulated learning. The stages involved are forethought, performance, and self-reflection. Forethought is the presented task that needs to be accomplished, which includes planning strategies and setting goals. The value attributed to the task, intrinsic interests, and self-

efficacy beliefs are part of the forethought. Zimmerman (2000) claims that the performance stage refers to self-observation and self-control activities that involve the use of strategies besides focusing attention. The final phase that Zimmerman (2000) puts forward is the self-reflection stage where there is an emotional reaction to the performance. In this stage, individuals tend to gauge their actions in comparison to other people's performances and their personal standards. When one perceives that he/she has performed better than others, they have a positive evaluation (Williams, 2008).

Williams (2008) highlights various learning strategies utilized by self-regulated learners. The students create and implement these strategies, which reflect a step towards taking responsibility for their learning. The strategies that facilitate learning include rehearsal, organization, elaboration, and retrieval. The author notes that the rehearsal strategies utilize repetition to foster the remembering of information. The rehearsal strategies are essential in promoting the short-term recalling of information. As students progress, they are less likely to use this approach because they focus on the need for long-term retention of relevant information. Williams (2008) further argues that the organizational strategies include an arrangement of information into significant groups with the purpose of evoking past information. Elaboration involves connections that are established between what is known and unknown. On the other hand, retrieval strategies include recovering long-term information or short-term memory.

Young (2005) presents empirical support for the underlying relationship between cognitive development and self-regulated learning strategies. According to Young

(2005), during the formative years of academic education, which also include college life, a student can deliberately choose to be proactive in a learning environment or can lack initiative and therefore not be receptive to learning. Remarkably, Young (2005) links the mental capacity of a learner to the deliberate decision to either excel or fail in the learning tasks. Moreover, the author dispels the notion that students learn by actively attending classes on a routine basis. On the contrary, he sustains that attending classes and engaging in the learning process are two different methods. His argument lays in the fact that student plays an active role in ensuring that there is self-regulated learning in their classes. Furthermore, Young (2005) asserts the importance of the motivation embedded in the process of nurturing self-regulated learning among learners.

James (2009) provides a quantitative survey of the traits that are notable for a college student who embraces self-regulated learning. According to this author, a significant relationship connects behavioral, motivational, and cognitive perspectives in a self-regulated learner. For instance, James (2009) argues that the behavioral aspect in class can aid in differentiating high and low performers. The activities that take place in class significantly assist in either motivating a learner to obtain greater achievements or ruin their desire to excel. Notably, James (2009) attempts to link behavioral and motivational dimensions to the cognitive perspective of growth. In this regard, cognitive dimensions of information processing can largely determine the behavioral goal setting abilities and the motivation to self-test to evaluate personal growth.

Bembenutty (2009) offers an array of critical perspectives with regards to self-regulation among learners and their outcomes within an academic context. First, Bembenutty (2009) asserts that self-regulated learners develop the ability to engage in self-generated thoughts. This viewpoint sustains that while learners participate in daily knowledge transmission from lecturers and books, these students take their learning experiences to the next level of internalizing and reinventing the concepts learned. Besides, James (2009) argues that feelings and actions that result out of such emotions are highly moderated in the context of the self-regulated learners. For instance, while a particular discipline may not be easy due to technicalities, a trend is notable in such a class. For example, there will be learners who will deliberately decide to single out that discipline as the cause of their failure. On the other hand, self-regulated students will embrace such a challenge, overrule their feelings of possible failure, and take motivated actions to ensure they succeed.

Bembenutty (2009) reports that self-regulated learners also possess the ability to delay other gratifications for the sake of the more imperative and urgent issues. The perspective also portrays the difference in the aspects of priority between the high and low performers. The ability to focus on what is considered a greater priority at every stage is important in self-regulative approaches (Bembenutty, 2009). In this regard, the capacity to distinguish between the goals a learner wants to achieve, versus what it takes to reach these objectives, is crucial.

Zimmerman (2008) recounts that while teachers may focus on the necessary strategies to foster a self-regulative learning culture among students, self-motivation is an individual initiative. According to Zimmerman (2008), while it is possible to harness motivation in students through learning strategies, self-motivation is more inbuilt as a trait. For this reason, the absolute satisfaction of a learner is important to assist in changing the students' attitudes and perspectives towards learning.

Zimmerman (2008) acknowledges that self-efficacy and confidence are significantly learned traits that a student develops from self-regulated learning strategies. In a situational setting where two sets of college students coded as the control group and self-regulated learning (SLR) group are investigated, Zimmerman's assumptions are vindicated. In the experiment, the control group received the necessary materials for a particular discipline and was subsequently left on their own. On the other end, the SRL group received the learning materials and adequate preparation to complete the tasks, including learning strategies for developing self-regulated traits. In the end, a survey indicates tremendous differences with regards to abilities that were noticeable in both groups.

Zimmerman (2000) further affirms that when students successfully receive the required self-regulation learning strategies, they are more likely to develop positive attitudes towards learning. Further, Zimmerman (2008) claims that the motivation needed to complete assigned tasks, regardless of how intricate they may be, are attributable to the self-regulation strategies incorporated in the learning process. The concept of motivation

is notable as an imperative aspect of the development of interests and values that aid in developing a self-regulated learner.

Kistner et al. (2010) observes that self-monitoring is one of the indelible attributes of college students who perform exemplarily in academia. Self-regulated learning assists the high performing students in understanding the essence of self-evaluation and self-monitoring. For instance, a high performer can monitor how long it takes to conclude a particular learning task. Zimmerman (2000) asserts that in undertaking such evaluations, a student can also develop a resilience to handle even the most daunting learning tasks. On the other hand, Pajares (2008) affirms that although self-efficacy is an imperative aspect achievable through self-regulated learning, the subject of interests and values arises. According to Pajares (2008), students may discover an array of interests while in college, and if such values and interests are not in tandem with the learning expectations, then a notable conflict of interest will arise. Conversely, Pajares (2008) reports that by nurturing self-efficacy and confidence in the learning environment, there is a likelihood of an apparent shift in the interest and values held by students.

In a more recent study concerning the possibility of predicting a student's grade point average (GPA) based on the academic motivation scales and the self-regulation learning scales, a unique perspective emerges. Cetin (2015) asserts that a direct correlation between self-regulation and the predictability of GPA scores among college students is absent. Many factors emerge as the possible pointers to the lack of direct linkage. According to Cetin (2015), unlike the GPA score that is quantifiable and

therefore easily measurable, the ability to inspect self-regulation and self-motivation may not be plausible. Evidently, the research that reveals the value behind self-regulation is qualitative. However, Cetin (2015) affirms that while it may not explicitly offer quantitative conclusions in this particular instance, it does not overrule the critical role that self- regulated learning plays in improving learning outcomes in class.

The concept of self-regulation is increasingly becoming acknowledged in different learning institutions because of its impact on students' performance. Wolters (2011) argues that self-regulation can be essential in helping students strengthen their diverse study skills while also enhancing their learning habits. According to Wolters (2011), the different approaches of self-regulated learning have been widely used to understand the various ways in which students monitor, understand, and manage their academics. Tapia and Panadero (2010) sustain that instructors can help students build on their self-assessment skills through different tested strategies such as rubrics and self-assessment scripts. Both scholars state that scripts include structured sets of relevant statements that are unique when approaching a given task. The scripts follow a specific expert model, thus there is a specific duty from beginning to end. Primarily, scripts are developed by instructors and are presented to the students in the form of questions so that they can probe and come up with solutions to a problem (Tapia & Panadero, 2010).

Montague (2010) asserts that substantial effects on self-regulation have been found with regards to mathematical problems, particularly among students who have learning disabilities specifically oriented to this field of study. However, scripts have

been found to be useful in promoting reading and writing. Hence, the effects of the self-assessment scripts on self-regulated learning are influenced by diverse variables such as the span of the intervention, and the quality and degree of script structure (Kollar, Fischer & Slotta, 2007). In this regard, self-assessment scripts can be said to have positive effects on learning and self-regulation. This underlying assumption is based on the fact that scripts focus the attention of students on monitoring and evaluating their learning processes. Consequently, a student's motivation is oriented towards mastering their goals rather than just performing. Tapia and Panadero (2010) stated that the information regarding the effectiveness of self-assessment scripts is rare in existing literature. Therefore, the scholars recommend that any research conducted involving the impacts of scripts on learning and self-regulation should be assessed under a range of conditions. In collaborative learning research, Jarvela and Hadwin (2013) indicate that students' learning should be considered as the cognitive process they use, and the outcomes of this process. Raes et al. (2016) named it as shared regulation and relate it to three types of regulated learning; self-regulated learning, co-regulated learning, and shared regulation.

Cleary and Zimmerman (2004) assert that educational psychologists deem the capacity to control an individual's discovery process as the key to educational success and beyond. Scholars have redefined the concept of successful learning besides providing essential environments prone to gaining knowledge, where attitudes and skills related to self-regulation are acquired. Additionally, the idea of self-regulation has been associated with the learners' capacity in the process of focusing his/her emotions, and thoughts and

actions to achieve the desired goals. Apprentices set their objectives to reach these goals based on the individual tasks that need to be undertaken. Making the assigned tasks involves monitoring, controlling, and adjusting their faculties of emotion, cognition, and action (Ting & Chao, 2013).

Kuiper (2002) argue that self-regulated learning can enhance metacognition. Improving metacognitive and critical thinking capacities imply increasingly gaining recognition in the contemporary world. The concept involves self-communication, cognitive strategies, and task demands that an individual engages in during the performance of a task and after finalizing. Self-regulation is receiving much attention from scholars recently because it has significantly influenced cognition. Failure to develop self-regulation in an educational setting restrains the student´s ability to achieve more in a vocational setting. The motivational and self-regulatory processes continue as one becomes an adult and have significant effects when one is setting goals (Kuiper & Ruthanne, 2002).

Pintrich (2004) puts forward some general assumptions with regards to the aspect of self-regulated learning. The four assumptions that are shared by most self-regulated models include firstly, the active constructive assumption that is derived from a general cognitive perception. Learners are active participants under this perspective; therefore, they are assumed to construct their goals, strategies, and meaning from the external environment. Secondly, the potential for control assumption presumes that learners have the capacity to monitor and control a particular aspect of their motivation, cognition, and

behavior, besides some notable environmental features. A third assumption held by most of the self-regulated models is the goal assumption. The assumption sustains that there is a set of specific standards or goals against which comparisons are created, to evaluate the learning process and determine if there is a need to progress or to change. The fourth assumption on the self-regulated approaches relates to activities that involve acting as mediators between contextual and personal characteristics and performance (Pintrich, 2004).

The field of educational psychology founded the idea of self-regulated learning. In the contemporary educational setting, the concept of self-regulated learning is gaining recognition in the area of language learning. Language learning courses are similar to other subjects offered in a school environment, and are therefore suitable. Lastly, self-regulation is also applicable in the reading comprehension of students.

Multimedia Learning

Currently, education faces numerous challenges such as overpopulation, changes with regards to the teacher's role, the development of educational philosophy, the increase in illiteracy, the mass media, and technological advancement (Wolff, Sjöblom, Hofman-Bergholm, & Palmberg, 2017; Cairncross & Mannion, 2001). Consequently, educational encounters in the modern world have to overcome social, economic, and cultural barriers. The education system has adopted modern technology with regards to teaching methods. Such technology is aimed at overcoming the challenges that teaching faces, which derails productivity and learning in schools. Also, the technological

innovation adopted in many schools considers the different learning capabilities of each student, hence offers equal opportunities to all (Karahan & Roehrig, 2016).

Most education systems have sought methods in which to mainstream technology that is relevant to the material being instructed, to improve productivity in education. Multimedia is the result of the mainstreaming of technological media, which in turn leads to the various applications of computer technology. The concept of multimedia technology application is broad and diverse; it is also a vital educational tool. Höffler, Koć- Januchta, and Leutner, (2017) note that the incorporation of a combination of multimedia tools is more efficient than using each one separately. Research also shows that multimedia technology is an ideal and useful educational tool as it addresses the sense of hearing and seeing simultaneously (Kemal, Ahmad, & Zewege, 2016). The multimedia technology incorporates programs that provide different stimuli to the recipient such as spoken word, sounds and music, texts, animations, graphics and still pictures. The elements of multimedia are streamed in a comprehensive and customized manner so as to enhance the participation of different senses. The multimedia technology is available to the learner in the form of various syllabi, which further enhances the learning experience (Scheiter & Eitel, 2016).

Most studies carried out in learning institutions indicate that the use of multimedia tools, especially with regards to computer usage, has a positive impact on cognitive and academic achievement, as well as efficient comprehension and application (Kern, 2006). Kern (2006) further observes that results from most studies emphasize the use of

multimedia as an active facilitating strategy that assists in delivering educational material to the students. Evidence from multiple studies also shows that multimedia technology in education has helped teachers to simulate the outcome of the students' performance (Clark & Feldon, 2005). Hence, the multimedia technology effectively compensates for some deficiencies found in conventional teaching methods.

The onset of technological advancements such as the Internet has caused educators to reassess the concept of learning, and to develop new strategies for teaching and impacting students. In this regard, there has been an increase in the production of instruction and learning software in the education market. Most of the software designed is aimed at assisting teaching, and delivering relevant information to students. However, the software developers, in many cases, do not have teaching experience. Therefore, most of the software lacks a theoretical background (Ogunyemi, Lamas, Adagunodo, Loizides, & Da Rosa, 2016). Consequently, the interface and presentation of some educational software designed for learning may be destructive for students. Designs with colorful animation and graphics serve as a distraction rather than a beneficial tool for the student (Kalyuga, 2012). Frechette and Moreno (2010) assert that effective instructional software should enhance the student's learning experience and level of understanding and comprehension. According to researchers, the development and design of multimedia platforms should focus on the learning and educational concepts of a particular field. Clark and Mayer (2016) suggest that the developers of computer-based teaching software should have adequate knowledge of the field and comprehensive understanding of

different cultural and social environments. Multimedia technology that utilizes computer aided programs should include the following concepts:

- scenario learning,
- case study learning,
- constructive and interactive learning,
- subject learning,
- cooperative learning,
- apprentice learning, and
- story learning.

It is important to mention that each of the concepts is independent of the others. Therefore, an ideal approach would be to integrate the relevant concepts into the learning process of a particular subject. Studies indicate that multimedia platforms are most effective when they implement problem solving, dialog inquiry, tutorials, drills and practice, instructional games and simulation (Clark & Mayer, 2016).

On the other hand, research in multimedia learning has been focused on the design process of multimedia principles and its effects on learning. The modality principle effects (Crooks et al., 2012; Schüler et al., 2012; Kalyuga, 2012,) and modality and redundancy principles (Schüler et al., 2013) emphasize this. Results of the aforementioned studies show that multimedia learning can be more effective than text-only learning (Burket & Azevedo, 2012). Experimental studies such as Hassanabadi, Sadat and Pakdaman's (2011) investigated 96 girl students of junior high schools who

learned from texts and animations using the modality of narration vs. on-screen text. The results showed that the narration group outperformed on-screen text group in retention (M = 4.44, SD = 2.34) having higher scores than text group (M = 3.29, SD = 2.11). Another quasi-experimental study examined 250 students' achievement when learning using Animation-Narration (AN) and Animation-Narration-Text (ANT) visual presentation (Adnan & Masood, 2012). The finding showed students in the animation narration group obtained a significantly higher achievement level compared to the animation narration and text group (t = 0.51, p = 0.61).

However, although several studies have investigated the effectiveness of self-regulation in the learning process (Dignath et al., 2008; Zimmerman, 2008), few studies have examined the effect of self-assessment techniques to measure whether they enhance self-regulation when learners work in multimedia environments. Besides, for the most part, research has overlooked the effect of using metacognitive strategies related to self-regulated learning in multimedia learning environments.

The representation of content that incorporates imagery and text often demands too much effort on behalf of the students, causing them to face difficulty when processing information (Mayer, 2005). Recent research has been conducted in which cognitive learning aids are integrated, to analyze whether these tools help students in the selection, organization, and integration of information. Although this process is related to self-regulated skills, the ultimate intention of these studies is to identify if students frequently use these aids. Also, the focus is to determine if learning performance is related to the use

of learning aids and not with the self-regulated process students use. In experimental studies by Ploetzner and Schlag (2013), and Kombartzky et al. (2010) involving sixth grade students, multimedia animation programs were developed following theories of multimedia. The purpose of both studies was to evaluate strategies for learning from animations.

In the experimental study undertaken by Ploetzner and Schlag (2013), pretests, posttests, and follow-up tests were administered to 152 sixth grade students using two different animation learning materials: dances of honeybees and sailing. The control groups wrote summaries about the content, while the experimental group used a learning strategy provided by the researchers. The procedure consisted of following instructions presented on a worksheet, as well as writing notes. MANCOVA results showed that the experimental group, using different animation learning material, had an improvement in performance (Wilks Lambda = 0.52, F (3, 61) = 18.28, p <.01) as well as retention, conceptual understanding, and transfer, with an effect size from medium to large for both. However, analysis of variance of the control group showed a decrease in the performance of students who participated in the animation of the dance of bees (Wilks Lambda = .93, F (1, 63) = 4.48, p <.05). The control group using sailing animation showed no significant difference between their performance and the experimental group (Wilks Lambda = .98, F (1, 63) = 1.59, ns) as the group with the bee dance animation (Wilks Lambda = .99, F (1, 81) = .67, ns).

Similarly, in Kombartzky et al. (2010), researchers proposed a strategy for learning in multimedia environments, specifically from animations. For that purpose, they conducted two experiments involving a population of sixth grade students. In the first one, the control group did not use the strategy, while the experimental group did. The results showed that the experimental group was significantly more successful than the control group in acquiring conceptual (M =2.78; SD=0.78) and rule-based knowledge (M = 2.14; SD = 0.87) as assessed in the posttest.

In the second experiment, the roles were inverted, and a monitored strategy was included where students received one instruction at a time on a worksheet. Results showed that experimental groups significantly outperformed the control group with respect to both conceptual knowledge, $t\,(1, 151) = -5.33$, $p < 0.001$, Cohen's $d = -0.86$, and rule-based knowledge, $t\,(1, 151) = -4.34$, $p < 0.001$, Cohen's $d = -0.70$. For both studies, students that incorporated the strategy for learning scored higher than those students placed in the control groups. In both studies, Ploetzner and Schlag's (2013) and Kombartzky et al.'s (2010) results showed that cognitive learning aids (strategy for learning from animations) in the program helped students improve their learning. However, in both studies, the researchers concluded that it was not possible to identify the frequency and depth of the cognitive processes employed by the students (Ploetzner & Schlag, 2013; Kombartzky et al., 2010).

Performance of Students in a Multimedia Environment

Most education and learning institutions have adopted various means of multimedia technology in the school system (Apperso, Laws, & Scepansky, 2006). There has been a significant improvement in the academic performance and learning of students who use multimedia technology. However, the design of multimedia materials is not entirely decisive in how much students learn. It is important to include how students can process information efficiently (Kombartzky et al., 2010). In spite of this, the use of multimedia in learning institutions has several potential benefits noted below that may occur when multimedia design is instituted correctly.

Personalized education: The educational or instructional software used in teaching aims to cater to students at their level of understanding. The software is beneficial to learners who process information faster and also to those who need more time to learn. As such, students with different learning capabilities can learn at the same pace and benefit from the multimedia technology (Smith & Woody, 2006).

Enhancement of traditional learning techniques: The use of multimedia technology incorporates the interactivity of traditional teaching methods with the latest technology. For instance, there is an immediate test feedback, which assists the tutor when accessing students' performance (Clark & Mayer, 2016).

Ideal for a variety of students and learning content: Multimedia technology incorporated in education provides an impartial learning environment. The learning environment offers privacy and independence to the students, without pressure from

tutors or other classmates. Additionally, self-learning is enhanced using multimedia technology as most courses have repetitive questions and instructions (Atkin, 1993). An ideal multimedia instructional platform involves the collective effort of educators, students, and programmers. The multimedia technology aims to reduce the time and effort taken to impart knowledge to the students (Clark & Mayer, 2016).

Concrete learning experience: Effective human learning experiences are based on three aspects: observation, practice, and thought (Lawless & Brown, 1997). The multimedia platforms offer educational information through a sequence of image and sound presentation. As such, students can comprehend and understand the courses; hence, their education performance is enhanced (Lawless & Brown, 1997).

Diverse teaching Aids: The multimedia platforms provide different teaching aids and materials for the students. Learning materials, in the form of texts, graphics, music, pictures, and animation can benefit a student in their cognitive development. As a result, students perform better with the use of the multimedia platforms.

High quality and efficient learning: The multimedia platforms eliminate the human factor that is associated with traditional teaching methods. Hence, the learning environment is more stable. Also, the instructional quality is assured as the multimedia platforms allow the students to learn at optimal conditions and at convenient times. Students' performance is also reported to increase with the use of the multimedia platforms (Lawless & Brown, 1997).

Simulated learning experience: In many vocational or technical courses, the acquisition of training and practical skills can be costly and even risky. However, by using the relevant multimedia technology, actual scenarios can be simulated efficiently without any risk or economic demands. Consequently, the students will acquire the required knowledge and skills in the comfort of their classrooms, and finally, apply the skills effectively in their respective fields.

Reduced psychological obstacles: According to Boling and Robinson (1999), students reflect different levels of learning and responding to education. For instance, some students may hesitate to ask questions in real time learning, due to psychological factors such as shyness or embarrassment, which affect their performance. Multimedia platforms eliminate such mental obstacles by offering a private space, neutral response, and reduced pressure from classmates and teachers. As a result, the student can learn at his/her pace, and his/her performance will significantly improve (Boling & Robinson, 1999).

Repetitive learning and direct Feedback: Unlike traditional learning methods, the multimedia platforms focus on enhancing individual learning through repetitive practice. Atkin (1993) noted that students can engage in the same course work multiple times until they fully comprehend it. This model is contrary to conventional learning methods, where learning is based on individual teachers' attitudes and teaching styles.

Dedicated teaching materials: The technology used in the multimedia platform is customized to meet specific requirements and goals (Zallio, Berry, Kelly, Rifai, &

Jakuska, 2017). Consequently, various instructional and educational software cater to a particular educational need. Students' performance is enhanced as they can select the program that is most suitable to their educational need and level of understanding, unlike traditional learning methods, where the teaching is generalized (Zallio et al., 2017).

Hyperlinked learning and effective motivation: The various forms of multimedia platforms provide diverse learning patterns such as hyperlinks that direct the students to other relevant information. Also, the interactive and creative audio and visual effect of the multimedia platform attracts the interest of the students, and in turn enhances their educational performance (Zallio et al., 2017).

Importance of self-assessment and self-regulation skills in multimedia environment/self- regulation learning

A student's self-assessment is vital to the learning process as it assists him/her in evaluating his/her achievement in a particular task (Pintrich, 2004). Self-assessment allows the student to access learning progress and also compare their performance to others. Regular self-assessment can assist a student in improving his/her future performance and in enhancing his/her education (Pintrich, 2004). The multimedia technology in education provides an online platform that integrates resources for learning and teaching. Self-assessment facilitated by multimedia technology assists students in regulating and monitoring their learning. This process promotes a deeper and more effective learning experience. Also, effective self-assessment requires clarity of standard, purpose, goal, and criteria achieved through alignment with an engaging curriculum.

Nicol and Macfarlane- Dick (2006) observed that an accurate self-assessment is required for effective self-regulated learning. The self-assessment can then assist the students in identifying and selecting new learning tasks. In self-regulated learning, the student handles planning, controlling, and monitoring of his/her learning process. The student selects the tasks he/she wants to work on, the duration to work on it, and the intensity of each task. Self-regulated learning is considered a constructive process that is ideal for advanced students and learners. The self-regulated learning strategies are actions or processes aimed at information acquisition and representing skills including the involvement, purpose, and instrumental student perception. The use of self-regulated strategies, in addition to providing an understanding of the status of self-efficacy, self-regulation increases personal-individual functioning, academic performance, and learning environment (Kinzie, 1990).

Nicol and Macfarlane- Dick (2006) further observed that self-regulated learning is not effective or ideal for novices who are new to a course or program due to the beginners' lack of efficient task selection and self-assessment skills, which are crucial to the self-regulated learning process. Aligned with this, Kinzie (1990) express that learner control, defined as students' capacity to base their actions and decisions with the acquired knowledge, can be seen as a prelude to self-regulation development. In fact, the generality of the studies has shown that independent field subjects show significantly higher learning achievement than their co-dependent field (Campanizzi, 1978; Kinzie-Berdel, 1988; Fernandez-Rio, Cecchini, Méndez-Gimenez, Mendez-Alonso & Prieto,

2017). Research shows that the instructional support and additional training including tutoring and prompts enhance effective self-regulated learning. Most multimedia platforms use instructional systems to personalize the educational information and access the students' level of knowledge, to effectively select or suggest the next learning task. The assessments consisted of several aspects of a student's performance and invested mental effort. Studies show that a prerequisite for effective self-assessment is for a student to monitor his/her progress while working on a task and construct an accurate mental representation of the task. Most learning tasks require a high cognitive load, especially for novice students. Also, when monitoring is interrupted, students may have a reduced or limited recollection of their performance, which will affect their self-assessment ability.

According to Pintrich and De Groot (1990), learners with high levels of prior knowledge self-assess more accurately due to their previous experiences that reduced the cognitive load required when learning tasks, resulting in students focusing more on monitoring task performance. Wolters (1998) notes that a hindrance to effective self-assessment is identifying the criteria or standard. In the self-regulated learning setup, inaccurate self-assessment can result in one selecting an inappropriate learning task. For instance, if a student overestimates his/her performance, he/she can quickly pick a subsequent task that is too challenging for his/her education level.

In self-regulated learning, it is important for students to identify the aspect of the task that is relevant to their learning process. For instance, they should take into account

the complexity of the task and the amount of support provided, as important factors to consider. Self-assessment is a vital part of the self-regulated learning. Therefore, the ability to efficiently select an appropriate task is crucial. Also, an efficient multimedia platform is essential to conduct an effective self-assessment (Song, Kalet & Plass, 2016).

Theoretical Framework

As established in Chapter 1, this research adopts the cognitive-affective theory of learning with multimedia (CATLM) as formulated by Moreno and Mayer (2007). Furthermore, these authors use theoretical assumptions on self-assessment and self-regulation. However, this framework seeks to establish a foundational basis upon which the latter theories can be discussed as integrated into CATML. CATML is an outgrowth of cognitive theory of multimedia learning (CTML). This section proceeds with a discussion of CTML before addressing the elements of CATML. The analysis affirms that CATML understanding is vital to both the self-assessment and self-regulation processes.

Cognitive Theory of Multimedia Learning

The cognitive theory of multimedia learning (CTML) stems from the notion that a learner's attempt to construct meaningful connections between text and pictures aids in deeper learning than when either is applied separately (Sorden, 2012). Sorden (2012) notes that according to the CTLM, multimedia theory instruction is the primary goal. The objective is to enhance a student's ability to create a 'coherent mental representation' from the material presented (Sorden, 2012). Here, the learner actively engages in the task

of making sense of the material, and this ultimately leads to the construction of knowledge (Sorden, 2012).

Multimedia is a combination of text and images, and multimedia learning occurs when mental representations are created from these mental pictures (Mayer, 2014c; Sorden, 2012). The words can either be verbal or written, and the pictures can be presented in any form of graphical imagery, which includes video, photos, illustrations, or animation (Sorden, 2012). Cognitive research is applied in formulating a multimedia instructional design to enhance learning (Sorden, 2012).

CTML is supported by many cognitive researchers who assert that multimedia helps the human brain's learning process (Sorden, 2012). According to Mayer's hypothesis, multimedia learning is itself a theory of cognitive learning (Sorden, 2012). The theory deals with methods of structuring 'multimedia instructional practices' and the application of more cognitive strategies to enhance learning (Sorden, 2012). Multimedia learning takes place when mental presentations are built from textual and pictorial content (Sorden, 2012). Yue (2014) refers to this as generative or germane processing. Germane processing involves cognitive activity, which enables the learner to create a precise mental model around the lesson's critical content (Yue, 2014).

Paivio (1986), as reiterated by Moreno and Mayer (2007), defined multimodal learning as involving the use of two content representation methods: verbal and non-verbal. A student is presented with the oral version of the content and its visual equivalent (Moreno & Mayer, 2007). Multimodal presentations are a combination of

textual and pictorial knowledge representations (Mayer, 2001). This application of both non-verbal pieces of knowledge to verbal explanations enhances the learner's comprehension of the content (Mayer, 2001). Moreno and Mayer (2007) affirm this position by stating that a combination of both representations through mixed-modality presentations proves to be the most affecting learning environment for students.

Mayer (2009) asserts that there is a distinction between meaningful learning, and rote or no learning. Meaningful learning is distinguished as it involves an active process where the learner constructs the presented material into knowledge (Mayer, 2009). Sorden (2012) explains that this is demonstrated where the novice applies given content to novel circumstances. Learners who undergo multimodal instruction processes score higher results in 'problem-solving transfer tests' (Sorden, 2012). Mayer (2008b) builds upon this position and identifies two transmission levels. The first notion refers to the transfer of knowledge where the learner's prior learning impacts new learning. The second is 'problem-solving transfer', which occurs when the student applies previous knowledge to resolve new issues.

Learning is defined as a change in knowledge, which is attributable to experience (Mayer, 2009). Learning occurs within the novice's cognitive system and cannot be submitted to direct observation (Sorden, 2012). Furthermore, an individual's understanding of the presented content cannot be estimated by directly quantifying his/her perception during learning. Rather, learning can be inferred through the learner's behavioral change (Sorden, 2012). An example occurs when the novice's understanding

is gauged from his/her performance in a test or task (Sorden, 2012). Meaningful learning is the outcome of the student's conscious cognitive process effort involving selection, organization, and combination of new data with existent knowledge (Mayer & Moreno, 2003).

Cognitive-Affective Theory of Learning With Multimedia (CATML)

As established in Chapter 1, CATML is founded on the cognitive and affective processes in multimedia learning. This theory is based on the CTML theoretical framework by incorporating learner motivation, emotion, metacognition, and individual differences (Yue, 2014; Moreno, 2006). CATML motivational factors mediate the learning process because of their effect on cognitive processing (Yue, 2014). CATML is founded on multiple cognitive assumptions, which according to Yue (2014) can be supported empirically. The first assumption is affective or emotional mediation, which states that a learner's motivation can either augment or reduce the usage of cognitive processes (Park et al., 2011). The second principle is metacognitive mediation where the metacognitive factors involved in learning regulate both cognitive and affective processes (Moreno, 2004). The final assumption is the novice's previous knowledge (Moreno, 2004).

Motivational factors regulate the learning process by either increasing or reducing cognitive engagement (Pintrich, 2003). When learning is self-regulated, interest becomes a key motivational factor. Research shows that students persist longer when studying texts based on a topic of their preference (Ainley Hidy & Beidu, 2002), which is related

to students' motivation (Barba, Kennedy & Ainley, 2016). Motivation is an event that should start the learning process. The student should feel involved in some way with the content that learns, to have more relevance and will not be arbitrary or compelling. According to Keller's model of Attention, Relevance, Confidence, and Satisfaction (ARCS), the environment can influence the motivation of the learner. In a teaching situation, the learning task needs to be presented so that a genuine commitment from the student is realized and established in a significant manner; the above is necessary to promote positive expectations for the achievement of learning objectives condition. The ARCS Model identifies four essentials components for encouraging instruction:

- attention strategies to raise and sustain curiosity and interest;
- relevance strategies that bind to the needs of learners, their interests, and motives with learning objectives;
- confidence strategies that assist students in developing a positive expectation for successful achievement; and
- satisfaction strategies to maintain intrinsically and extrinsic reinforcement, valuing the efforts and achievements in perspective (Keller, 1983).

According to the above, socializing agents such as strategies within the theory of Keller increases and favors an increase in the regulation of behavior. In other words, the self-regulating behavior expresses that the operation of the subject arises from the purpose and the subject's consciousness about his performance and needs (Suárez-Álvarez, Fernández-Alonso & Muñiz, 2014). The self-regulating behavior then involves

student engagement with tasks, the wish to do, which compromises their motivation to complete it, which is in harmony with the theory of Keller and its four essential components, in particular with the relevance component. As Keller (1983) asserts, the significance is present if students perceive that they can perform the task and meet their learning needs. This student's perception occurs when a relationship between the desired goals and activities to be performed is established.

On the contrary, a learner's concentration is less likely to be sustained when he/she is reading content that does not interest him/her. Yue (2014) links this to the ordinary expectation that people will watch captivating videos more than boring ones. Consequently, teachers may be inclined to apply instruction designs to increase learners' interests. Mayer et al. (2001) cautions instructors to ensure that such interest cultivation do not culminate into the introduction of overly extraneous processing. This position is anchored on the Baddeley's (1992) concept that different information modalities are processed through separate channels (Baddelev, 1992). Therefore, only a few fragments of information can be actively processed at any given time in working memory within each channel (Mayer, 2014b). Even so, research seems to suggest that prior knowledge (Magner et al., 2014) and working memory capacity can mediate the impairment occasioned by seductive details (Yue, 2014).

Metacognitive factors refer to people's awareness of their cognition and are an indispensable constituent of CATLM. Metacognition is vital in some mental processes including learner comprehension, communication, and memory (Yue, 2014). A student's

personal assessment of a variety of study techniques and his/her rate of learning will influence his/her subsequent study behavior (McCabe, 2011). The course of metacognition involves monitoring and control. According to Yue (2014), these processes begin with object-level and meta-level interactions and distinctions. The object-level action is the actual mental process where a novice comprehends a video narration (Nelson & Nares, 1994). On the other hand, a meta-level action entails a cognitive interpretation of the process where the learner becomes aware that he has understood the videos' content (Nelson & Nares, 1994; Yue, 2014). Such a realization then determines whether a student opts to watch the entire video or replay some portions of it (Yue, 2014). Thus, it is correct to infer that the meta-level is informed by the object level (Yue, 2014). When a novice receives new information at the object level, his/her 'meta-level mental model' is either modified or takes note that change is not necessary (Yue, 2014).

The present dissertation is concerned with the interface between CATML metacognitive and affective factors, and learner self-regulation. The interaction of CATML components affects a student's self-regulation and self-assessment methods. For instance, a novice's interest in a topic determines his persistence in studying a text. At the metacognitive level, the student can assess his/her comprehension of the content and the ease of learning. This self-evaluation then informs the student's future study methods. Empirical results validate self-assessment and self-evaluation (Panadero et al., 2013). A self-regulation model enables learners to take charge of their learning by identifying the

tasks, planning, monitoring, and evaluation. CATML provides a backdrop against which students can assess their learning ease, difficulties, and emotions. CTML is also important because it improves the brain's learning capacity.

Summary

The literature review identified different research approaches employed in the study of the use of scripts, and the focus on research in multimedia learning. Scripts have been considered, principally, as a means to enhance collaborative process in computer support collaborative learning environments. Also, scripts are viewed as scaffolds that help students improve their learning in specific contents. Research focuses on how theory principles affect the learning process or how cognitive aids help students to use measuring learning related to multimedia learning. Literature shows that scripts and procedures incorporated in multimedia learning offer an opportunity to enhance knowledge. Nevertheless, further research that analyzes which metacognitive skills are related to self-regulated skills is scarce.

Self-regulation requires learners to take charge of their learning through task identification and effective planning and evaluation. Before engaging at this level, the student should be able to acquire new information through different representation modes. The use of both textual and pictorial presentations is necessary to enhance the learning process. Under CATML, motivational factors such as interest should be cautiously taken into consideration by instructors. The objective is to cultivate learner concentration, rather than to strain the worker's memory. Also, the metacognition

components of monitoring and control provide an interface between cognitive theories and self-regulation. At the meta-level stage of metacognition, the learner can make cognitive interpretations and become aware that he/she has understood the presented material. As a result, it is correct to infer that the interaction of CATML components affects a novice's self-regulation and self-assessment methods. A cognitive self-evaluation enables the learner to establish his/her subsequent study patterns.

Chapter 3: Research Method

The purpose of this quasi-experimental pretest/posttest non-equivalent control group study was to determine whether there was a significant and meaningful difference in student learning while using or not using a script as a self-assessment tool in multimedia environments. Also, this study included a self-regulated learning questionnaire to identify self-regulated strategies that students used with and without scripts, to learn with a multimedia lesson. This study was designed to compare students' achievement in a control group and a treatment group.

In this chapter, I describe the setting, participants, and sampling technique. I also describe the design including the validation process for questionnaires used in the study. Finally, I describe the treatment process including the script, statistical analysis, and ethical procedures employed in conducting this study.

Setting and Sample

Setting

This study was conducted in a secondary public school in Puerto Rico during regular English class hours. This community secondary school serves students from Grades 6 through 12. The school had an active enrollment at the end of the year 2014 of 404 students, of whom 325 (78%) were under the poverty level based on their free or reduced lunch eligibility. The school belongs to a one rural municipality of Puerto Rico and offers educational services to the adjacent community neighborhoods. Currently, the school operates from 8:00 a.m. to 3:00 p.m. According to the Department of Education in

Puerto Rico, results of a recent standardized test in the pre-basic level of English reflected a decrease of 19% in 2013. On the other hand, at the basic level, scores reflected an increase of 18% compared to 2011 to 2013. In the proficient and advanced categories, the school reflected an increase of 6% in 2012-2013 compared to 2011-2012; in the advanced proficient level, there was a reduction of 3%.

Participants

In the quantitative study, it was important that the findings from the sample be generalizable to the larger student population. The sample consisted of all students in four pre-selected classes, totaling 94 secondary students. These students ranged in age from 16 to 18 years and were enrolled in 11th and 12th grade English courses. The study was in a real-life setting using a non-random convenience sample of four previously assembled groups by the school office, containing approximately 25 to 30 students per class. Two classes were in the control group and the other two were in the treatment group. This convenience sample selection process affected the validity of the study. However, to minimize this threat to validity, I assigned the intact classes randomly to control and treatment groups, and measurements for goal orientation were gathered from both groups, to determine how comparable they were. If they had not been similar in terms of goal orientation, this variable would have been used as a moderator to account for these differences.

Probability sampling was considered and rejected. Probability sampling refers to the use of random selection or probabilistic methods with the purpose of creating a

sample whose units are representative of the population they represent (Cohen, Manion, & Morrison, 2013). With random selection, each unit has an equal chance or probability of being selected. The use of random selection improves the chance of producing a representative set of subsamples (i.e., treatment and control), and also provides the researcher with approaches to estimate how likely they will be (Laerd, 2015). One requirement for probability sampling was that I get access and work with a list of the population, in this case, a list of students enrolled in the 11th and 12th grade groups. However, there were problems with this requirement. I work in a real-life setting, and access to the list of students could have resulted in a confidentiality violation. Therefore, probabilistic sampling was not appropriate for this study.

Use of non-probability sampling was common in designs similar to the current study. Creswell (2009) stated that quasi-experimental designs allow interventions in a real-life setting and do not require random assignment. However, these interventions in a real-life setting affect the internal and external validity of the study. One significant limitation in a convenience sample without random assignment is its effect on external validity. The results of the current study could not be generalized to the larger population. Also, as stated by Fraenkel and Wallen (2010), the other limitation that affects internal validity in non-random sampling is that the interpretation of significance levels cannot involve precise values.

Non-probability sampling refers to the subjective judgment of the researcher when selecting units from the population to be included in the sample. One way of

selecting my sample was convenience. Convenience sampling was suitable for various reasons. The purpose of the study was to obtain information about the learning process in a real-life setting, using a particular method. The research questions involved the use of a method in which data from specific characteristics of the sample were not included or did not have an effect on the outcome. In addition, convenience sampling was an inexpensive and fast method to use. However, the most important reason to use this non-probabilistic method was to gain access to a list of students without an invasion of their privacy, which was protected by the Family Educational Rights and Privacy Act. These reasons led me to choose a non-probabilistic sample using a convenience sampling strategy.

Each participant's parents were asked to give consent for their child to participate in the study. Also, each student completed the consent form, and his or her participation was voluntary. Both consent forms were to be completed before the study began. Each student's homeroom teacher provided a random identification number on these consent forms, which allowed teachers to refer back to these numbers when labeling the students' surveys and conceptual maps rubrics. Also, because the data collection included their conceptual maps grade result, students received a confidentiality agreement form indicating the data would not be discussed for other purposes apart from the study. The consent form specified that participation in the study and use of a scoring rubric (i.e., the dependent variable of learning in this study) would not affect students' course grade. Completion of these conceptual maps was a normal part of the class curriculum, and

therefore students received grades for completing these maps. These grades were separate from the study procedures.

After supporting the selection of my sample using a non-probabilistic design for convenience, analysis with G*Power indicated that for adequate power, the sample of my study should be at least 88 students, as shown in Figure 3. I used a multiple linear regression with three predictors as nominal variables such as teacher, fidelity of implementation, and goal orientation. This model was used for both research questions. To compensate for attrition, a sample of 100 was planned.

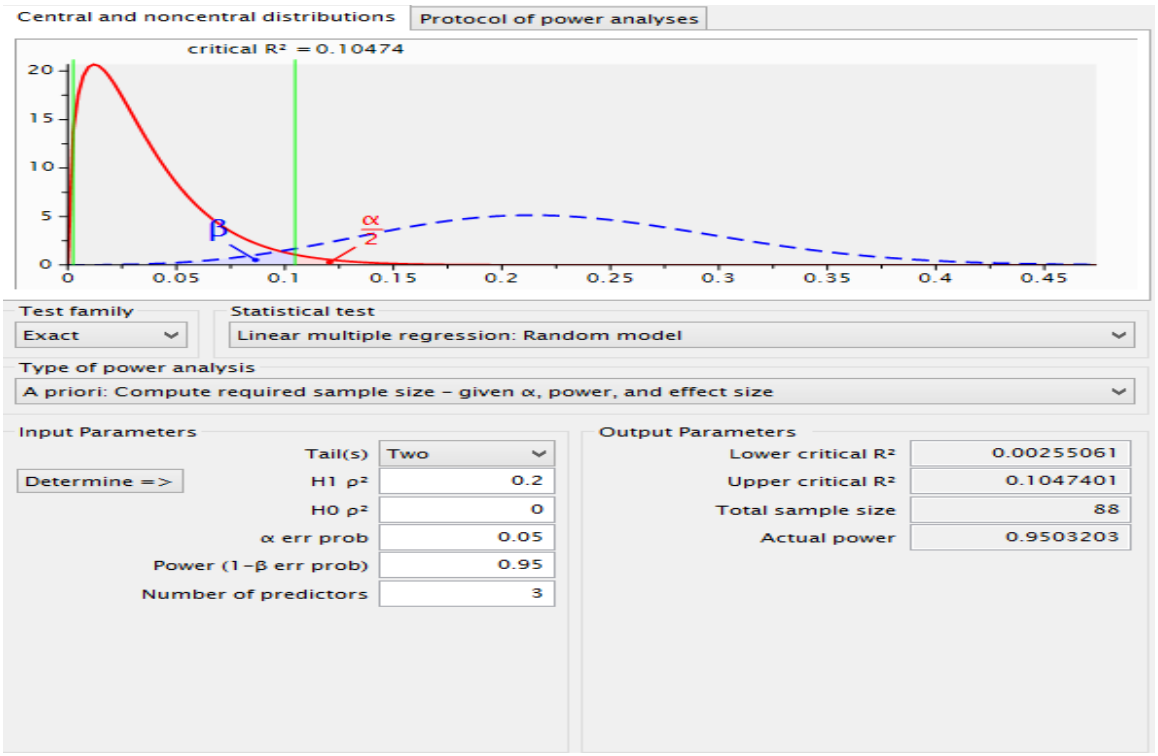

Figure 3. Power analysis using G*Power software.

Research Design

To answer the research questions, the design of this study was quantitative quasi-experimental, using two pretest/posttest treatment and control groups. Dependent variables were measured with two self-regulated learning questionnaires, the second week conceptual map worked by students as a pretest, and the sixth week conceptual map as a posttest, scored with a rubric (Appendix G) that was used to measure learning for this variable in the study. All students who consented to participate in the study took these surveys. However, all students in English class completed the conceptual map as part of the normal class curriculum. For this study, the second week conceptual map was used as a pretest. The sixth week conceptual map was the posttest, and both were scored using a rubric (Appendix G) for the dependent variable of learning. The treatment group completed these conceptual maps using the script. The control group did not use the script. However, use of the script was a teachers' prerogative, so the researcher observed implementation fidelity of the script. Although the conceptual map scoring rubrics were not part of the curriculum, the creation of conceptual maps was a part of the class curriculum; the class grading, and rubric grading were separate procedures, and student class grades did not reflect the rubric scores in any way.

The non-equivalent control group design was criticized because its assumptions can affect validity if they are violated (Campbell & Stanley, 1963). Internal validity refers to the degree to which inferences can be made about the cause and effect, and may be related to other factors involved in the study that cannot be controlled (Creswell,

2003). Assigning these intact classes randomly to comparison and treatment group strengthened internal validity.

Groups 1 and 2 were called the control group, and Groups 3 and 4 were called the treatment group. However, this design suffered from other threats to validity: selection bias, maturation effect, testing effect, diffusion effect, and regression effect. These threats are discussed next.

Selection Bias

Selection bias exists when participants in the control group and treatment group were not equivalent by their demographic characteristics among others. If members reflected differences in their academic abilities, this could reflect differences related to skills and no treatment-related differences. To reduce this threat and ensure the comparability of groups at baseline, all participants had to complete the Motivation and expectations of learning questionnaire (MAPEX), Spanish acronym of LEMEX questionnaire, which measured goal orientation (Appendix D, D-1).

Pintrich (2004) states that goal orientation is a predictor that activates self-regulation. According to the type of goal the student sets, they will be willing to turn to the strategies needed to regulate themselves when facing difficulties (Zimmerman, 2008). Goal orientation was measured at pretest to confirm whether all groups of students were motivated to achieve the same objectives. If they were not, the goal orientation would be used as a moderate variable in the analysis.

Maturation Effect

The maturation effect occurs when there are significant changes in the knowledge and attitudes among the pretest and posttest. These changes can be linked to events or processes that occur as time passes during the study and are not caused by the treatment. The time between the pretest and posttest in this study was only four weeks, so this threat was insignificant.

Testing Effect

The testing effect may be secondary to the application of the measuring instrument; in particular, a familiarity of the individual with the test develops, which determines that in subsequent measurements the same skills improve gradually. In the present study, to measure learning and self-regulated learning (SRL), the instrument was different in the pretest and posttest, so there was no SRL testing effect threat in the study design.

The achievement measure assessed the conceptual maps created by students in the control and treatment groups. In this sense, repeated use of the conceptual mapping activity was intended to cause change in learning. However, students did not see the scoring rubrics, so there was no testing effect due to the rubric.

Diffusion Effect

Diffusion occurs if treatment groups interact with control groups, and discuss their experiences, resulting in some predisposition or change, in knowledge and attitudes because of group dissemination in the other group. To minimize this effect, the teacher

was trained in the implementation process for the treatment group. Also, the researcher was an observer to evaluate the fidelity of the implementation process for the scripts that were used only in the treatment group. The researcher completed an observation checklist (Appendix I); the teachers' performance ensured only students in the experimental group received the script. These ratings were collected as measures of fidelity of implementation, "but they are also directly relevant to the evaluation of diffusion effects" (Craven, Marsh Debus & Jayasinghe, 2001, p.641).

Research Questions for This Study

The following research questions and hypotheses were developed for this study.

RQ1: Does the use of a script as a strategy for self-assessment in multimedia learning affect students' learning?

$H_0$1: There is no significant difference or meaningful effect size in students' learning when comparing those who use a script as a strategy for self-assessment in a multimedia learning environment and those who do not.

H_a1: There is a significant difference and meaningful effect size in students' learning when comparing those who use a script as a strategy for self-assessment in a multimedia learning environment and those who do not.

RQ2: Is there a difference in self-regulation strategies used by students who incorporate scripts as a strategy for self-assessment in multimedia learning compared with students who do not?

$H_0$2: There is no significant difference and meaningful effect size in self-regulation strategies between students who use the script as a strategy for self-assessment in multimedia learning and students who do not.

H_a2: There is a significant difference and meaningful effect size in self-regulation strategies between students who use the script as a strategy for self-assessment in multimedia learning and students who do not.

Instrumentation

Instrument for Assessing Dependent and Moderating Variables

I used the Questionnaire of Learning Motivation and Expectancies (LEMEX) (MAPEX in Spanish) (Alonso-Tapia et al., 2010) (Appendix D, D-1) to assess goal orientations as a moderating variable, to ensure populations of treatment group and control group was similar across the four classrooms. It contained 178 items divided into 15 scales, and measured goal orientations: learning performance and avoidance goals with an average reliability (Cronbach's α) for different scale and subscale of .80. For the purpose of this study, the researcher omitted 12 scales following the author's recommendations to measure what is needed for this study. The researcher used three scales that directly measure goal orientation. The final questionnaire thus contained 50 items divided into three scales that measured the direction towards goals, using a Likert scale as shown in Table 1.

The scales are "motivation for learning", "rejection of work and academic tasks" and "disposition to effort". To obtain a score for each scale, I added the score of each

item after inverting scores as follows: if 5→1, if 4→2, if 3→3, if 2→4, if 1→5 (Appendix B). I obtained an individual's score of each scale separately to assess if students differ or not in goal orientations. This score was found by totaling the responses and performing descriptive statistics to find the average score of each participant in each scale. A One-Way ANOVA was then performed to test if groups differ. The score ranged from 1 to 5. This questionnaire was completed in approximately 25 minutes. If participants showed differences on pretest, goal orientation was used as a moderating variable.

Self-Regulation Measures

The study used two separate questionnaires, one for the pretest and one for the posttest. The purpose of this was to compare the use of self-regulated skills between the treatment and control groups at pretest and again in posttest. There was no interest in judge if there was any change in the use of self-regulated skill in both groups.

Several instruments for assessing self-regulation were employed. The measure of the self-regulated strategies that the students use, with or without a script, was two questionnaires; the Motivated Strategies for Learning Questionnaire (MSLQ, Appendix C, C-1) and Emotion and Motivation Self-Regulation Questionnaire (Appendix A) (EMSR-Q) (Alonso-Tapia et al., 2014). As suggested by Samuelstuen and Bråten, (2007), to assess self-regulated learning, a combination of instruments is better than one single tool. This questionnaire had two general scales necessary grouping five subscales (Appendix B). In general, it consisted of 20 items to answer, each on a five-point Likert

scale. The overall scale of "Learning self-regulation" has eight elements that were actions oriented according to self-message and learning objectives. In Cronbach's test, this scale resulted with a reliability index of α .78. The scale of performance/avoidance self-regulation included self-posts or actions that showed a lack of self-regulation or performance-oriented activities. This scale has 12 items that have a reliability index α .86. I obtained an individual's score of each scale separately, to assess if both groups differ or not on self-regulated skills. This score was found totaling the responses and performed a descriptive statistic to find the average score of each participant in each scale. The score ranged from 0 to 4. Then, a One-Way ANOVA was performed to test if group differ.

The Motivated Strategies for Learning Questionnaire (MSQL) is a self-reported questionnaire that had 81 items divided into two categories: the motivation section and the learning strategies section. The Motivation section measured the goals, value beliefs, and control thoughts, ideas about skills to succeed, and test anxiety. The Scale of Learning Strategies included 31 items relating to the students' use of different cognitive and metacognitive strategies (Ramirez-Dorante, Canto, Bueno-Alvarez, & Echazarreta, 2013). It also contained 19 items about managing different resources for learning by the student, with a total of 50 items divided into 9 subscales. The metacognitive subscale included planning, monitoring, and regulation. Three subscales assess the cognitive strategies students use: rehearsal, elaboration, and organization strategies. According to Pintrich et al. (1991), the scales can be used to fit the needs of the researcher or

instructor. For this study, the researcher used just the subscale in the MSLQ that has 12 items, to measure the dependent variable self-regulated learning. This subscale measured cognitive and metacognitive strategies and was focused in control and self-regulation aspects of metacognition. This document was administered at the beginning of the study as a pretest to see self-regulation process students used before using the script. As Pintrich et al. stated, "the instrument is designed to be given in class and takes approximately 15 minutes to administer" (1993, p. 13).

Developers found the predictive validity correlating students' final course grades with both MSLQ scales. Pintrich et al. (1993) used confirmatory factor analysis for both motivation and learning strategy subscales to assign items to each factor. The results of each factor analysis indicate reasonable validity.

The developers used Cronbach's alpha and zero-order correlations to measure the reliability. They used Cronbach's alpha to estimate the internal consistency for each of the 15 MSLQ subscales. Alphas ranged from .52 for the help-seeking scale to .93 for the self-efficacy scale. Pintrich et al. (1993) argue that these alpha coefficients for the MSLQ scales are robust and demonstrate good internal consistency. The zero-order correlations between the different levels suggested valid measures. In a recent study with high school students in Tehran, Feiz, Hooman, and Kooshki (2013) investigated the validity and reliability of the MSLQ questionnaire, finding a total scale reliability coefficient of α =.957. In a Meta-analytic review of the MSQL, Credé and Phillips (2011) concluded that the questionnaire has a reasonably reliable measure of construct that support its

theoretical structure. The questionnaire was developed to be given in class (Pintrich, Smith, Garcia, & McKeachie, 1991) because it was designed with a feedback form. I added the individual's score items to find the average. The score ranged from 1 to 7. After that, I performed a one-way ANOVA to find the differences between groups.

Measure for Learning Improvement Dependent Variable

At the beginning of the study, the students watched a PowerPoint presentation about how to create a conceptual map. After that, for six weeks, the students worked with an English unit content. At the end of the first two weeks, all students watched a PowerPoint or a video summary of the week, and then they prepared a conceptual map of the week's unit worked in their regular class. This second week's conceptual map was scored by the researcher using a rubric (Appendix G) as a pretest. In addition, two external professors received an interrater reliability training to rate the conceptual maps at the end of the study.

During the next four weeks, students completed four conceptual maps in their English class after seeing a summary of their English class in a PowerPoint presentation. The treatment group used the script while preparing their conceptual maps. Participants in both groups completed a conceptual map once they concluded the unit. To measure the learning improvement, all students' sixth week conceptual maps were scored using a rubric by the researcher (Appendix G). The score of the second week conceptual map, rated with the rubric, was subtracted from the score of the sixth week conceptual map for each student. Any teacher feedback or grade on the conceptual maps were a typical part

of the class procedures, and were not of interest to the study. The conceptual map score was found by adding the grading number for each assessment criteria in the rubric (Appendix G), ranging from 1 to 4: concepts, hierarchy, relationships among concepts in different hierarchical levels, relationships among concepts from different columns, and simplicity and easiness of understanding. The total grade was found generating a single index number from 20=100 to 4=20.

Instruments Used for the Treatment

Self-Assessment Tool: script

To design the conceptual map, students in the treatment group used a self-assessment script developed by the researcher using an expert model (Appendix F). Students who consented to participate in the study used it during each conceptual map development at the end of each week.

Multimedia Presentation

A multimedia presentation about how to prepare a conceptual map was shown to teachers and students prior to the process of the study. A multimedia, a video or PowerPoint presentation developed by the researcher and accepted by the English teachers, showed the students a process to create a conceptual map and a week's summary of the content worked in the English class during each week. This ensures that both groups had an equivalent explanation of the requirements for the conceptual maps.

Treatment

The research participants were secondary students from grades 11 and 12, in an English class course. Two weeks before starting the study, the English teachers for all students who participated in the study received training about the development of a conceptual map using the multimedia video. They also received training on how students used the script in the classroom to develop the conceptual map. The purpose of the training session was to familiarize the teachers with the study to be performed, and to introduce the treatment group's teachers with the use of the script. This also ensured that both treatment and control groups had an equivalent understanding of the requirements of the conceptual maps. In addition, two external professors received an interrater reliability training, to rate the second and sixth conceptual maps at the end of the study.

First, students who consented to participate in the study, both in the treatment and control groups, completed the goal orientation self-regulated questionnaire in their regular homeroom setting. After completing it, the teacher showed the video in which students received instructions about how to create a conceptual map.

I designed the script in my role as the researcher. For its initial trial, this was used for everyone in the treatment group. However, after they completed the study, students in the control group received the same treatment as the treatment group in the next six-week English unit if the intervention was shown to improve student achievement. In addition, the script document was available to use in other school course content at the close of the study. The researcher was not directly involved in teaching the sections in the study and

had no direct contact with the participating students. One volunteer English teacher allowed the researcher to conduct the study in the class setting.

As previously described, for the purpose of this study, a six-unit English content was taught by each teacher to his or her treatment and control group classes. At the end of each week, a PowerPoint or video summary about the week's content was shown in their regular classroom setting. For the first two weeks, all students created a conceptual map for each week's content without using the script. The second week conceptual map, scored with a rubric (Appendix G), was used as pretests. Then, students in both conditions saw the video about how to create a conceptual map. The treatment group received a second training during the six-week class about how to use the script as they created their conceptual maps.

Students in both the treatment and control settings completed, in the next four weeks, the last four conceptual maps at the end of each week and after watching the video summary. At the end of the unit, the sixth week conceptual map was graded using a rubric. Also, students completed the second self-regulated questionnaire (Appendix B). By administering these measurements to all students, the scores from these assessments were compared between the treatment and control groups. Use of this procedure did not require different consent forms for either group.

Data Collection

This study had multiple sources of data collected. These data included the goal orientation survey, self-regulation surveys (LEMEX, MSLQ and EMSR-Q), and the

rubric for the students' conceptual maps. As a quasi-experimental, non-equivalent (pretest/posttest) control group design, all data points were collected from a time point before the students started participating in the study, and at the end of the six weeks' courses (Figure 4). Students were notified that their rubric scores did not influence their class grades.

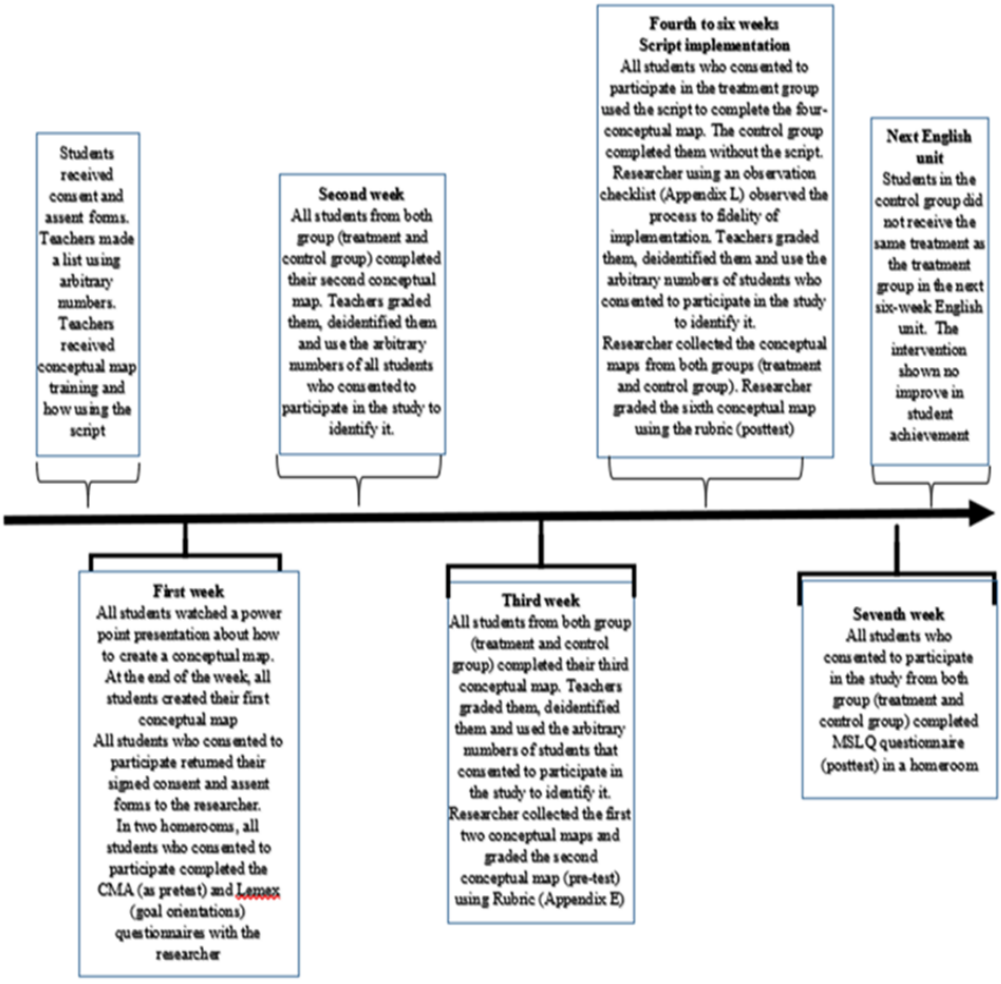

Figure 4. Research timeline.

At the beginning of the study, in their respective homerooms, the consenting students returned their signed consent and assent forms, and the teacher provided a unique identifier number for each student's forms. The participating teachers then listed this same number on each of the following surveys to ensure that all data can be matched confidentially, and that consent could be properly attributed to each student who participated. Before the pretest, students completed two questionnaires in two homeroom sessions: Questionnaire of Learning Motivation and expectancies (LEMEX) (MAPEX in Spanish) (Alonso-Tapia et al., 2010). This questionnaire assessed goal orientations to identify group similarities. Students then took the Emotion and Motivation Self-Regulation Questionnaire (EMSR-Q in English and CMA in Spanish) (Alonso-Tapia, et al., 2014) as a pretest. At the end of the course, students took the second self-regulated learning questionnaire named Motivated Strategies for Learning Questionnaire (MSLQ) as a posttest. At the end of the course, week-two conceptual maps, and week-six conceptual maps were graded using the rubric (Appendix G). These documents were rated by a panel of two experts as measuring the performance of the control group and the treatment group. Rubric scores did not influence students' grades in their respective classes and was only used as data for the study.

Fidelity of Implementation

To minimize threats to implementation trustworthiness, two teachers were trained on the conceptual map development process and the study protocol. It was important to ensure that both groups had an equivalent understanding of the required procedures so

that differences between the groups did not arise as a result of extenuating circumstances. Thus, this training helped improve the implementation reliability (Kershner et al., 2014) because it measured its process and its core components. In the implementation process, students in both groups worked in a regular classroom hour, which was the time exposed to treatment. The treatment implementation, classroom time procedure, and teachers' recall about the use of script during conceptual map working hours was assessed by the researcher's direct observation using an observation checklist (Appendix I).

Data Analysis

The design of this quasi-experimental study was a pretest/posttest control group. The purpose was to identify whether there was a difference in student learning between students who used a script as a self-assessment tool, and those who did not employ this technique when working in a multimedia environment. I analyzed the data by conducting a multiple regression statistics. Ordinary least square multiple regression model let me manage missing data, including the variables predicted as covariates.

In general terms, all data collection was done using questionnaires and rubrics that had numerical data. However, the researcher created a codebook in which to describe the content, structure, and layout of each data collected. It had a variable name, label, question text, values, and value labels; it also had the summary statistics and missing data, where applicable.

To manage the different variable for data analysis, the following raw data preparation codebook (Table 1) showed the basic elements to start the data analysis. I

used this codebook table at the time when the real analysis was performed to enter the variables data.

Table 1

Codebook Table

Variable No.	Variable name	Data type	Collection time	Numeric code	Enter number	Per student
LEMEX1	Motivation	nominal	First data collection	Scale score average	1,2,3,4,5	x
LEMEX2	Rejection	nominal	First data collection	Scale score average	1,2,3,4,5	x
LEMEX3	Disposition	nominal	First data collection	Scale score average	1,2,3,4,5	x
SRPretes1	Avoidance SR	nominal	Pretest first week	Scale score average	0,1,2,3,4	x
SRPretes2	Performance SR	nominal	Pretest first week	Scale score average	0,1,2,3,4	x
SRPretes3	Negative SR	nominal	Pretest first week	Scale score average	0,1,2,3,4	x
SRPretes4	Process SR	nominal	Pretest first week	Scale score average	0,1,2,3,4	x
SRPostes5	MSLQ	nominal	Posttest	Scale score average	1 to 7	x
Rubric2	LearnPre-	nominal	Second week	Single Index Number	20=100 4=20	x
Rubric6	LearnPost	nominal	Sixth week	Single Index Number	20=100 4=20	x
7	FidTeacher1	nominal	Four to sixth week class	Raw score	2= Present and correct 1= Present, but not following the procedure 0= Missing or incorrect	Per class
8	FidTeacher2	nominal	Four to sixth week class	Raw score	2= Present and correct 1= Present, but not following the procedure 0= Missing or incorrect	Per class
9	EffecTeacher1	nominal	Four to sixth week class	Raw score	2= Present and correct 1= Present, but not following	Per class

Variable No.	Variable name	Data type	Collection time	Numeric code	Enter number	Per student
					the procedure 0= Missing or incorrect	
10	EffecTeacher2	nominal	Four to sixth week	Raw score	2= Present and correct 1= Present, but not following the procedure 0= Missing or incorrect	Per class

I performed the data screening to check if data had been entered correctly, check missing values, and check for outliers and normality. The first step was running descriptive statistics to find missing values in the frequency table. In addition to screening the data, the descriptive statistics checked for multiple regression assumptions as outliers. It included the value of Skewness and kurtosis with the standard error for each. Also, these procedures allowed the researcher to see the extreme values and the boxplot, which displayed mild and extreme outliers. To deal with outliers if any, the researcher transformed the variables, at the same time, created normal distribution, and reduced the influence of outliers. To check the assumption of normality, in a descriptive statistic, the researcher analyzed the frequency with a histogram with a normal curve, which provided a useful graphical representation of the data. Also, the researcher ran a Kolmogorov-Smirnov test (K-S) and a Shapiro-Wilk (S-W) test to examine normality using the mean and standard deviation of my sample. To deal with no normality, a log-transformation could fix this issue.

Hypothesis testing was done using OLS multiple regression analysis. Furthermore, other assumptions were checked to determine the adequacy of multiple regression analysis. The appropriate model specification was first checked because error term was enlarged when the right variables were excluded. The OLS regression model was the right kind of multiple regression analysis because it allowed me to include all the explanatory variables that could be found in the study such as teacher effect, group differences in goal orientations, and the implementation process. The model (OLS) allowed the researcher to predict the effect of the independence variable in the dependent variable, considering the other explanatory variables. Also, it was a strong model that produced the smallest error possible, let it be a model that fix the study analysis.

The next assumption was the normal distribution of residual errors. This meant that the residual errors in the normal population should have a variance of zero and one.

The third assumption was that the regression line produced by ordinary least squares was considered, in the dependent variable, only within the lower and upper natural limits of the same. The fourth assumption was homoscedasticity, which meant equal variance. When the method of ordinary least squares found the estimators, it was assumed that the variance of the model errors was the same for all the observations. This meant that there was equal dispersion or variance. When homoscedasticity was violated, it was understood that there was heteroscedasticity. This implied that the variances of errors were different for each observation. If the assumption of homoscedasticity were violated, plotting the squared residuals of the model versus the estimated values of the

dependent variable, stabilizing alterations of the variance that would change this. However, the ordinary least squares (OLS) model minimized the residuals, producing the smallest possible standard errors (Statistics Solution, 2013). If heteroscedasticity arose, in addition to changing the dependent variable, the regression of the absolute value of the residues on different functional forms of the variable suspected of producing heteroscedasticity could be calculated. On the other hand, if structure of the heteroscedasticity was known, it was possible to transform the data and apply the method of ordinary least squares. In general terms, OLS regression model was a robust analysis that required that the violation of the homoscedasticity supposition must be quite severe to present a significant difficulty to this model of regression.

The statistical process was performed using SPSS version 24. To address the questions of this study, the researcher used ordinary least square multiple regression. The statistic selection was based on the threats that the design of the study faced. It was usually essential to include multiple independent variables in the statistical model to forecast the dependent variable as precisely as possible. Multiple linear regression permitted us to test how well we could foresee a dependent variable by multiple independent variables. Therefore, the researcher included the moderator variables from the two scales of LEMEX questionnaire results, Motivation and Disposition, where the students showed differences. Variances of these explained the relative influence of each independent variable. The results of the second conceptual map (pretest) developed by students were not included as moderator variables because they did not show differences

between the treatment and control groups before implementation of the scripts. To test the hypothesis for the second research question, I performed two-independent sample *t* tests.

Ethical Procedures

This study was conducted according to Walden University's research protocols. Participation in the study was voluntary, and parents and students were notified in the consent form that non-participation in the study did not affect their grades, and participants could withdraw from the study at any time, without consequence. I did not have working relationships with any of the student participants in the study. As the participants, were not my own students, I did not expect any influence of power differentials or coercion. In addition, participants were assured that their conceptual map rubric scores did not influence their class grades, although completion of these conceptual maps was a normal part of their class curricula. The use of the rubric for the study only ensured that participants who are not provided the treatment were not disadvantaged, as students were graded separately based on the teacher's typical grading procedures.

The process of the study was explained before the first classroom meeting, in an easily understandable language, and the participants were offered the opportunity to ask questions, if they had any. In addition, the informed consent and assent consent informed parents and participants that their involvement was voluntary and without any form of coercion, to force them to complete or remain in the study, and that they finalized the

study without any mental or physical harm. They were reminded that they could withdraw from the study at any time and could complete the conceptual maps with or without the script if they chose.

The participants' confidentiality and privacy were protected during the data collection, analysis, and interpretation by completing all the questionnaires in the pretest and posttest without writing their names on the documents, rather using an arbitrary identifier number assigned by the teacher. The homeroom teacher assigned these identifiers to students for them to write on the completed consent forms and each survey so that the researcher could match data accurately, and ensure that only consenting individuals were included. A confidentiality agreement was given to each participant before the study. The researcher and students' teachers were the only people that had access to the data used for the purposes of this study. Also, the school district superintendent and the school director reviewed and evaluated this study to ensure that it followed the ethical standards they have established for completing research in any public school in Puerto Rico.

Summary

The purpose of this study was to discover quantitative effects on students' achievement by measuring the performance of a comparison group and a treatment group when using and not using a script as a self-assessment instrument while working on the development of conceptual maps. In this chapter, the researcher reasserted the research questions and the hypotheses that guided this study. Also, discussed in detail is the

description of the population, sample size, and methodology of the study. It included aspects related to research design, data collection procedures, and treatment and implementation of data analysis and ethical procedures, to assure participants rights. In Chapter 4, the data collection and analysis as discussed in Chapter 3 are further explained. Also, I discuss discrepancies in data analysis, as explained in Chapter 3, because of modifications in the school organization.

Chapter 4: Results

In this quasi-experimental study, the purpose was to analyze whether there was a difference regarding student learning when using a script as a self-assessment tool, versus other techniques that exclude scripts when working in multimedia environments. The study was conducted on public secondary school students in Puerto Rico. I analyzed the difference in self-regulation strategies employed by students who use scripts as a strategy for self-assessment in multimedia learning. The quasi-experimental design included a pretest and posttest analysis to assess the dependent variable learning. I used two questionnaires to measure the dependent variable, self-regulated learning. The cognitive-affective theory of learning with media was used to guide the study. The following research questions and hypotheses addressed the objective of this study:

RQ1: Does the use of a script as a strategy for self-assessment in multimedia learning affect students' learning?

$H_0$1: There is no significant difference or meaningful effect size in students' learning when comparing those who use a script as a strategy for self-assessment in a multimedia learning environment and those who do not.

H_a1: There is a significant difference and meaningful effect size in students' learning when comparing those who use a script as a strategy for self-assessment in a multimedia learning environment and those who do not.

RQ2: Is there a difference in self-regulation strategies used by students who incorporate scripts as a strategy for self-assessment in multimedia learning compared with students who do not?

$H_0$2: There is no significant difference and meaningful effect size in self-regulation strategies between students who use the script as a strategy for self-assessment in multimedia learning and students who do not.

H_a2: There is a significant difference and meaningful effect size in self-regulation strategies between students who use the script as a strategy for self-assessment in multimedia learning and students who do not.

This chapter includes the study's population, sample size, and description of the data collection. The data analysis included the statistical assumptions for the variables learning and self-regulation.

Study Population and Sample

The population of this study was students from a secondary public school in Puerto Rico. The size of the school population was approximately 450 students. The sample for this study was students from one 11th grade group and three 12th grade groups. Intact class groups were randomly assigned to script groups and non-script groups, and students knew about the study after being enrolled in the course. The 11th-grade sample had 24 students, and the 12th-grade sample had 23, 23, and 24 students for a total of 94 students. From the original sample, seven students did not want to participate

in the study. Figure 5 shows how gender was represented in the treatment and control groups. Gender was not considered an essential factor to conduct this study.

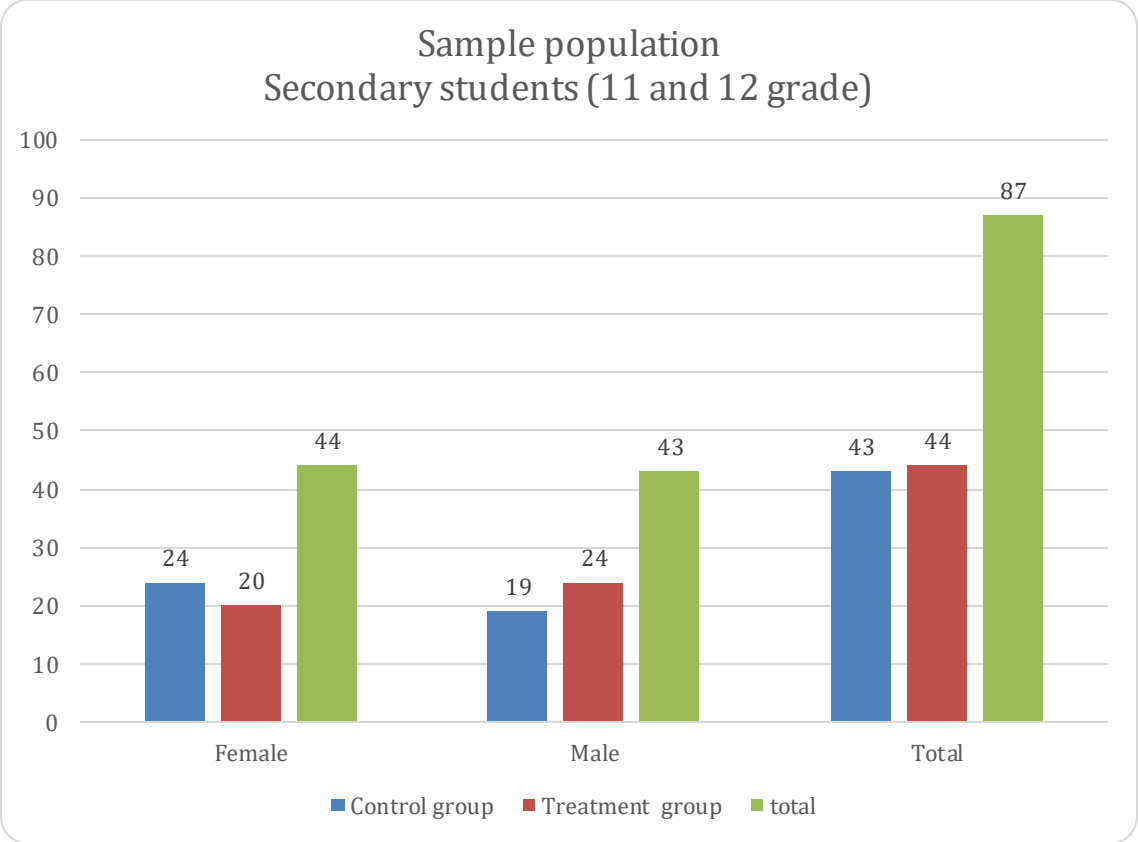

Figure 5. Sample population by gender in each group.

Data Collection

The District Office for Research issued permission prior to the beginning of the study. I also obtained the school's and principal's letter of approval to conduct my research on October 13, 2016. This study also met Walden University's ethical standards as confirmed by the institutional review board (IRB Number 07-10-17-0199715).

However, I had to wait until August 2017 to start data collection because schools in Puerto Rico are on summer break in June and July.

As soon as the academic school year started on August 7, I met with the homeroom teachers and the school principal in the school office, to explain the process and solicit the teachers' cooperation to collect the data. Both teachers agreed to participate and signed the data collection coordination request, and teacher consent form for control and experimental groups. During the 2016-2017 school year, two English teachers worked with students at the secondary level. However, during the 2017-2018 school year, the school required only one English teacher for Grades 11 and 12. Consequently, I observed one English teacher and recorded her actions related to her general classroom patterns about script implementation in the experimental group and timed class procedure in both groups (experimental and control). For this observation, an observation checklist (Appendix I) was used.

The observation checklist was used to assess timed class procedures in both groups to verify the use of multimedia. The teacher used the same timed class procedures in both groups to present the class with the multimedia, and for the students to create the conceptual map. Also, the observations included modeling and recalling what the teacher performed while the students used the script. These observations verified the fidelity of the implementation of the script in the treatment group while they worked with the conceptual map. Also, no visible teacher effect differences were observed between the groups. Consequently, there was no need to analyze the fidelity of the implementation

because the teacher provided the same timed class procedures in both groups, and followed the protocol for the script implementation in the treatment group. During the first day, the English teacher received training in conceptual maps and the use of the script. The data collection process started in August, the first week for students, and continued until October 2017, following the timeline described in Figure 6.

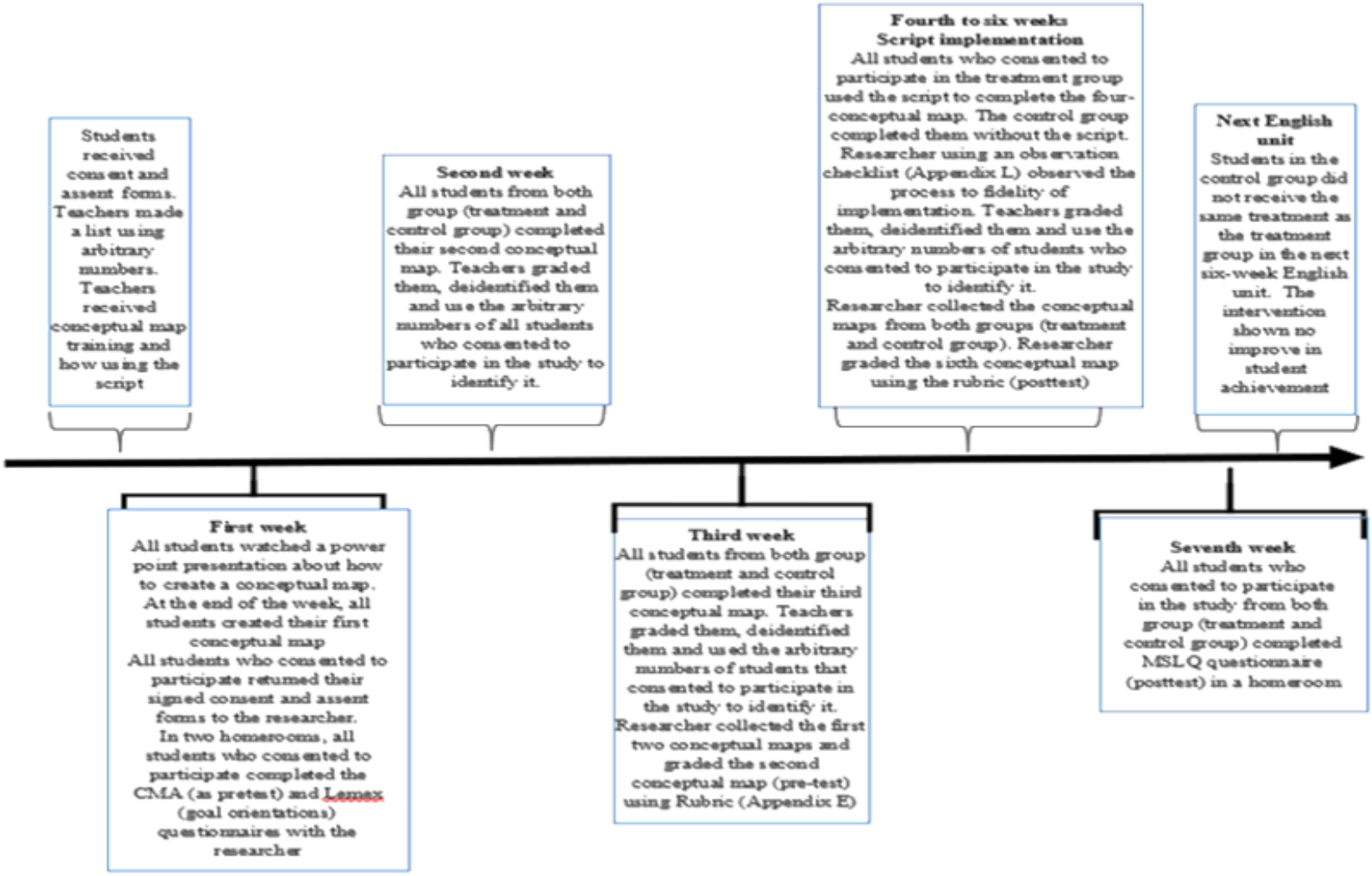

Figure 6. Data collection process timeline.

During the first week, 94 students from 11th and 12th grade received the informed consent and parent consent forms. Only 87 students agreed to participate and delivered the signed documents in a timely manner. In the second homeroom of this first week, students who consented completed the first questionnaire (LEMEX) to assess goal orientation. An independent sample *t* test showed a difference in two scales of the questionnaire. The results were used as a moderator variable. They also completed the first self-regulated learning questionnaire as a pretest (CMA). Both questionnaires were completed in a timely manner.

During the second week, students completed their second conceptual map after the English teacher showed the unit review in a multimedia presentation. The English teacher graded the conceptual maps and de-identified them using arbitrary numbers for every student who agreed to participate in the study. To identify if there are any differences between groups, and to assess equivalences, this conceptual map (pretest) was graded using the rubric. An independent sample *t* test identified that there were no differences between groups. Therefore, the pretest was not used as moderator variable.

Interrater Reliability

The dependent variable learning was measured using a rubric score (Appendix G) for the conceptual maps students worked on in their English class. The conceptual map score was determined by adding the grading number for each assessment criteria in the rubric ranging from 1 to 4: Concepts, Hierarchy, Relationships among concepts in different hierarchical levels, Relationships among concepts from different columns and

Simplicity and easiness of understanding. The total grade was determined by generating a single index number from 20=100 to 4=20. These graded rubrics were rated by a panel of two experts as measuring the performance of the control group and the treatment group. These two external professors received an interrater reliability training to rate the second and sixth map at the end of the study. Also, they did not have any academic involvement with the participants of the study.

An interrater reliability system was used to determine the reliability of the analyses. Two university professors, who are education specialists at a college level, checked a random sample of 20 rubrics: 10 from participants in the control group and 10 from participants in treatment group. Each interrater reviewed the same twenty rubrics. The interrater's percentages of agreement with the investigator were calculated and reported to assess the overall reliability of the rubric.

I calculated a Cohen's Kappa analysis for the reliability process. Cohen's kappa was used to measure the agreement between the two graders. In this study, I calculated the Cohen's kappa three times to find the average value. After completing the analysis, I compared the final value with the standard values for Cohen's kappa. For this study, one faculty member was considered as rater 1, and the second faculty member was considered as rater 2. The following evaluation codes were considered to grade the conceptual maps:

- 100-90 = 5,
- 89-80 = 4,
- 79-70 = 3,

- 69-60 = 2, and
- 59-50 = 1.

Ten conceptual maps from the control group and 10 conceptual maps from the treatment group, selected randomly, were graded by both raters using the rubric. The results are indicated in Table 2.

Table 2

Interrater Grade Results

Conceptual map #2	Graded rubric by researcher	Graded rubric by interrater 1	Graded rubric by interrater 2
Treatment			
4	3	3	3
10	3	3	3
13	2	2	2
18	3	2	2
22	2	2	3
23	3	3	3
29	1	1	1
38	1	1	1
42	3	4	3
44	1	1	2
Conceptual map #6	Graded rubric by researcher	Graded rubric by interrater 1	Graded rubric by interrater 2
Control			
7	2	2	2
10	1	1	1
14	2	2	1
18	1	1	1
19	1	1	1
27	3	3	3
29	1	1	1
31	2	2	2
32	2	2	2
42	2	2	2

I ran a Cohen's κ to determine if there was agreement between the rubric graded by the researcher and the rubric graded by rater 1. Table 3 shows the Kappa results of the

agreement. There was very good agreement between the researcher and rater 1, $\kappa = .852$ (95% CI, .666 to 1.038), $p < .0005$.

Table 3

Agreement Between the Research and Rater 1 Results

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Measure of Agreement	Kappa	.852	.095	5.694	.000
N of Valid Cases		20			

I ran a Cohen's κ to determine if there was an agreement between rubrics graded by the researcher and the rubric graded by rater 2. Table 4 shows the Kappa results of the agreement. There was good agreement between the researcher and rater 2, $\kappa = .699$ (95% CI, .434 to .964), $p < .0005$.

Table 4

Agreement Between the Researcher and Rater 2 Results

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Measure of Agreement	Kappa	.699	.135	4.416	.000
N of Valid Cases		20			

I ran a Cohen's κ to determine if there was an agreement between rubrics graded by rater 1 and the rubric graded by rater 2 (Table 5). There was good agreement between rater 1 and rater 2, κ = .705 (95% CI, .455 to .955), p < .0005.

Table 5

Agreement Between Rater 1 and Rater 2 Results

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Measure of Agreement	Kappa	.705	.128	4.708	.000
N of Valid Cases		20			

Goals Orientations

The LEMEX questionnaire consisted of three scales to assess goal orientations; Motivation, Rejection, and Disposition scale. The results of the Motivation and Disposition scales of LEMEX questionnaire (MAPEX in Spanish) were included as moderator variables because they showed differences between the treatment and control groups before the implementation of the scripts.

Assumptions and Data Analysis

To assess the equivalence between control and experimental group, a comparison of the results of goals orientation questionnaire (LEMEX) and the results of the second conceptual map for each group were used. An independent *t* test was used to compare the results of three scales of LEMEX, and the conceptual maps scores. A Mann-Whitney U test would have been used instead if the assumptions of the independent sample *t* test were not met.

For the study design, the first three assumptions were met. The three assumptions include variables were continuous, independent variable is categorical with two groups, and the design had independence of observations. For the next three assumptions related to the data, a one-way ANOVA and Multiple Regression statistical test was performed through the IBM SPSS statistic 24 program.

Data Analysis

Independent *T* Test for Goal Orientations and Second Conceptual Map

For an independent *t* test, the fourth assumption is that there are no significant outliers. This assumption was analyzed using a Boxplot for each scale of the LEMEX. Figure 7 shows that there were outliers for the Disposition scale based on the inspection of the boxplot.

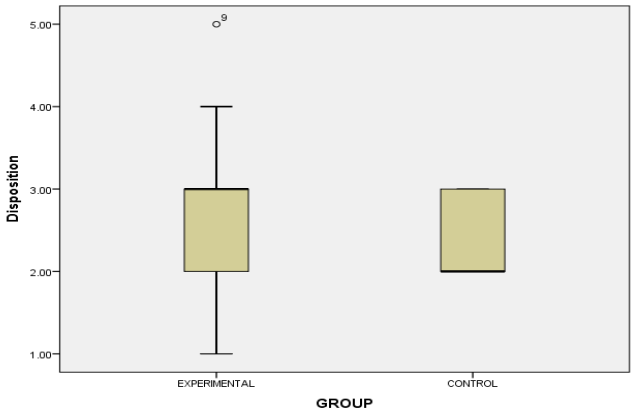

Figure 7. Boxplot of variable disposition in control and treatment group sample. The figure indicates that there were outliers.

For the Motivation and Rejection scales, Figures 8 and 9 show that there were outliers based on the inspection of the boxplot.

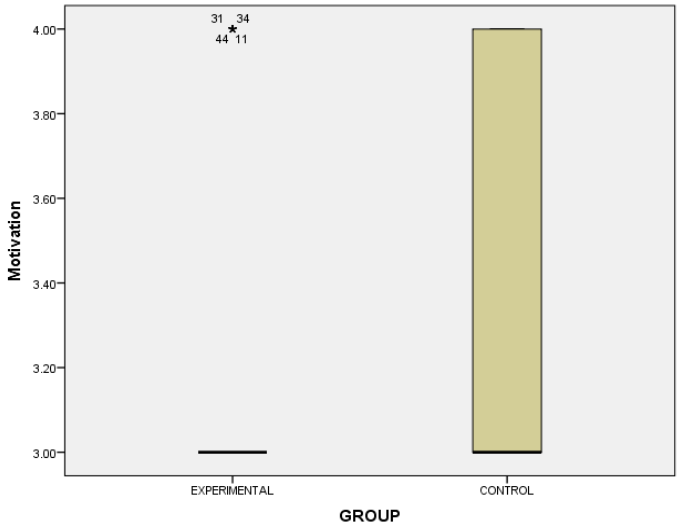

Figure 8. Boxplot of variable motivation in control and treatment group sample. The figure indicates that there were outliers.

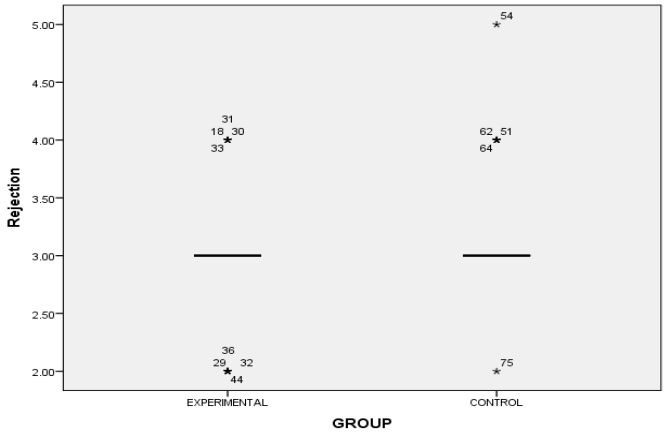

Figure 9. Boxplot of variable rejection in control and treatment group sample. The figure indicates that there were outliers.

To deal with outliers, the first data screening was performed to check if the data had been entered correctly. There were no coding or data entry errors. I also checked for

missing values. The next step, before transforming the variables, was to check if the data was normally distributed. This is because "transformations are usually not warranted unless the data is not normally distributed" (Laerd statistics, 2015). Transforming the data should be considered only if it is necessary when the normality assumption is violated (Laerd statistics, 2015). I did not remove the outliers because the normality test was also not met. I ran the non-parametric Mann-Whitney U test instead of a t test. This parametric test can be used to determine differences between groups as the t test and the outliers do not affect the test.

The test for normality that was used was Kolmogorov-Smirnov because the sample consisted of more than 50 subjects (Table 6). For both groups, in each scale the normality assumption was not met. Motivation, Rejection, and Disposition scores were not normally distributed for both groups, as assessed by Kolmogorov-Smirnov test ($p < .05$).

Table 6

Normality Results

	GROUP	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Motivation	Treatment	.507	44	.000	.440	44	.000
	Control	.345	43	.000	.637	43	.000
Rejection	Treatment	.375	44	.000	.701	44	.000
	Control	.469	43	.000	.562	43	.000
Disposition	Treatment	.297	44	.000	.842	44	.000
	Control	.405	43	.000	.613	43	.000

To deal with transformation for normality, the distribution shape was checked in both groups. The differences in shapes, specifically in skew, did not make possible the transformation (Laerd statistic, 2015). Figure 10 shows the differences in shapes for each scale data set.

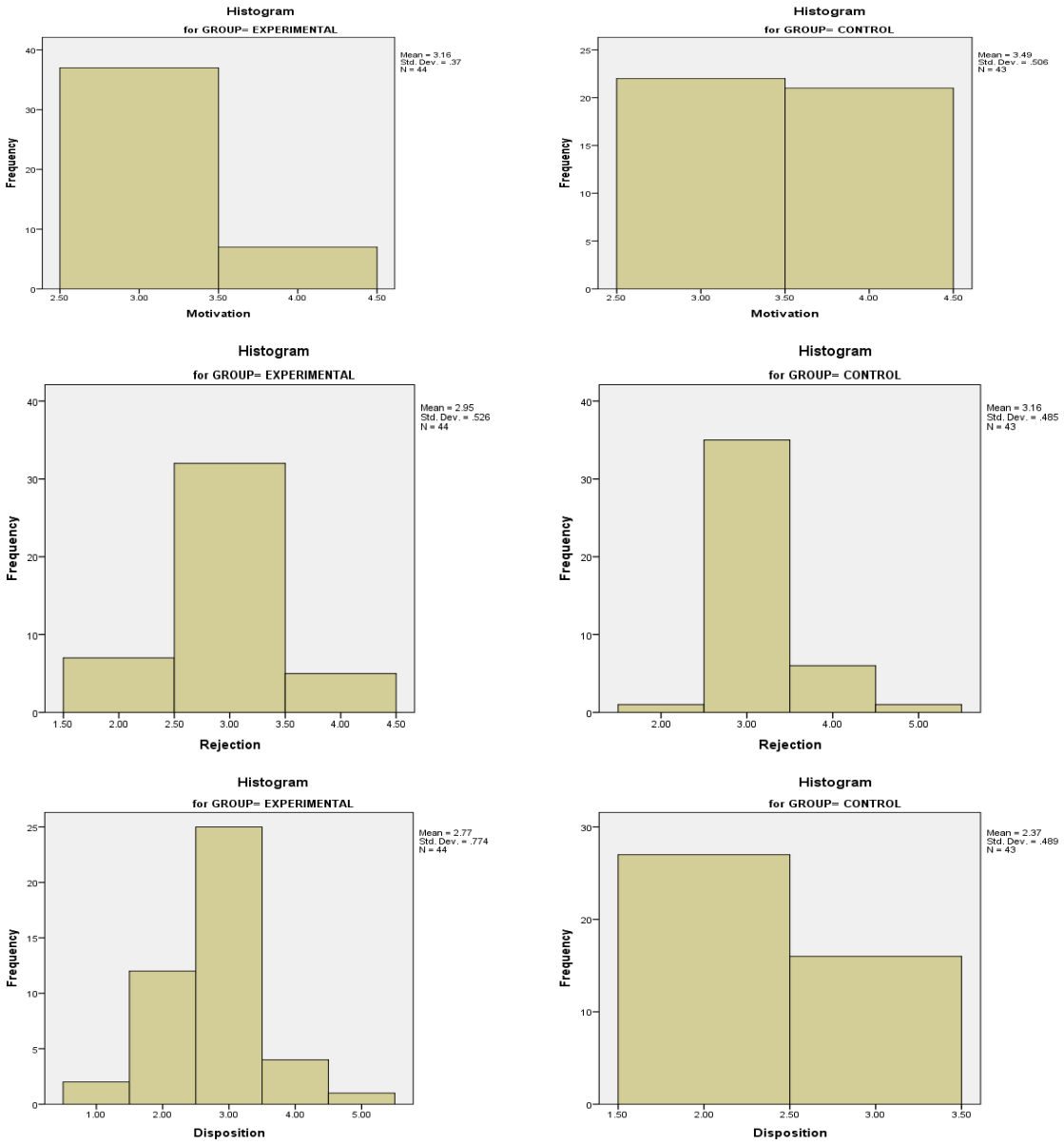

Figure 10. Differences in shapes for each scale data set.

An alternative approach to dealing with outliers and non-normal distribution in a *t* test was to run a Mann-Whitney U test instead (Laerd Statistics, 2015). A Mann-Whitney U test must meet three assumptions related to the study design and one related with to the data. The first assumption was met because the LEMEX questionnaire has a Likert scale from 1 to 5. The second and third assumptions were that the independent variable is categorical with two groups, and the independence of observations. Both assumptions were met because the participants in the control group were not in the treatment group. There were intact groups formed by the school administration and students were not allowed to move from one group to another.

For the next assumption, based on the distribution for two scale scores, Motivation and Disposition, differences in the control and treatment groups were found. Based on the distribution for scale scores for Rejection, there were no differences.

A Mann-Whitney U test was run to determine if there were differences in Motivation scores between control and treatment groups. Distributions of the Motivation scores in the control and treatment groups were not similar, as assessed by visual inspection. Motivation scores for the control group (mean rank = 51.24) were statistically significantly higher than for the experimental group (mean rank = 36.92), $U = 1{,}257$, $z = -3.268$, $p = .001$.

A Mann-Whitney U test was run to determine if there were differences in Disposition scores between control and treatment groups. Distributions of the Disposition scores for control and treatment groups were not similar, as assessed by visual inspection.

Disposition scores for the treatment group (mean rank = 50.95) were statistically significantly higher than the control group (mean rank = 36.88) for, $U = 640$, $z = -2895$, $p = .004$.

A Mann-Whitney U test was run to determine if there were differences in the Rejection scores between control and treatment groups. Distributions of the Rejection scores in the control and treatment groups were similar, as assessed by visual inspection. The rejection score was not statistically significantly different between the control group (Mdn=3) and the treatment group (Mdn=3), U = 1,105, $z = -1.796$, $p = .073$. Because of the significant difference between groups in Motivation and Disposition scores, these variables were used as moderator variables in a multiple linear regression.

Second Conceptual Map (Pretest)

Table 7 shows the descriptive statistics for the control and treatment groups. There were 44 students in the treatment group and 43 students in the control group. The mean for students in the treatment group scores in pretest was (M=64.47, SD=10.11) and for students in the control group was (M=61.86, SD=9.82). These results show that although students were in different groups, they were equivalent at the beginning of the study. However, an independent sample t test was performed to assess group equivalency.

Table 7

Descriptive Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Rubric2	Treatment	44	64.4773	10.11903	1.52550
	Control	43	61.8605	9.82121	1.49772

The first three assumptions for *t* test and the fourth assumption were met. The boxplot in Figure 11 shows no significant outliers in the data.

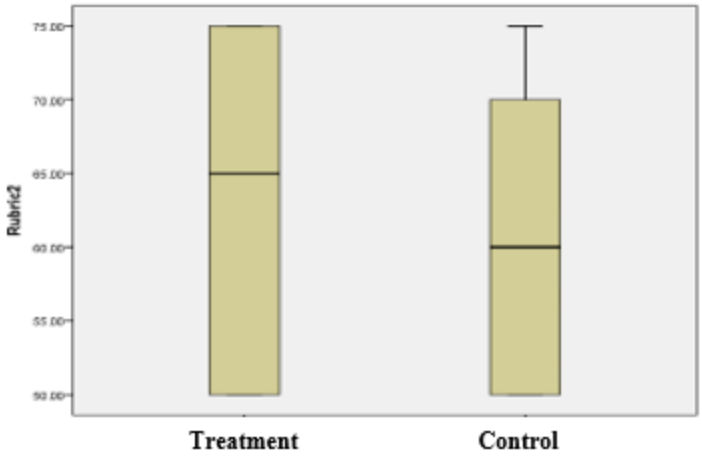

Figure 11. Groups pretest boxplot. Figure shows no outliers.

However, normal distribution of the data was not met as assessed by Kolmogorov-Smirnov test in Table 8, which illustrates a significance value of $p < .05$. The independent-samples *t* test is robust to deviations from normality. Also, the sample sizes are nearly equal and too large with respect to the normality violations. Only strong violations of normality might cause problems (Laerd Statistics, 2015). In fact, independent samples *t* test is a robust statistic, and the violation of normal distribution does not affect Type I

error rate (Laerd Statistics, 2015). Accordingly, the assumption of homogeneity of variance was met in order to continue with the *t* test.

Table 8

Group Test for Normal Distribution of Data

	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilks		
		Statistic	df	Sig.	Statistic	df	Sig.
Rubric2	Treatment	.196	44	.000	.812	44	.000
	Control	.212	43	.000	.845	43	.000

A Levene's test was performed to assess the assumption of homogeneity of variances. As shown in Table 9, there is a significant value greater than .05, indicating homogeneity of variances for pretest scores for control and treatment groups, as assessed by Levene's test for equality of variances (p = .842).

Table 9

Levene's Test for Equality of Variances

									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Err Difference	Lower	Upper
Rubric2	Equal variances assumed	.040	.842	1.224	85	.224	2.61681	2.13857	-1.63525	6.86887
	Equal variances not assumed			1.224	84.996	.224	2.61681	2.13783	-1.63378	6.86739

An independent samples *t* test was run to determine if there are differences in pretest scores between the control and treatment groups. The pretest score for the control group was (M = 61.86, SD = 9.82) and treatment group was (M=64.47, SD=10.11), showing that there is not a statistically significant difference, M = 2.61, 95% CI [-1.63,

6.86], t (85) = 1.22, p = .842, d =.26. These results showed that students in the control and treatment groups are equivalent in terms of learning and developing the conceptual maps, while working with multimedia as shown in Figure 12. In this sense, these results were not considered as a moderator variable for the study. The pretest scores were used to find learning variables, and for finding the differences between pretest and posttest scores (six-week conceptual map).

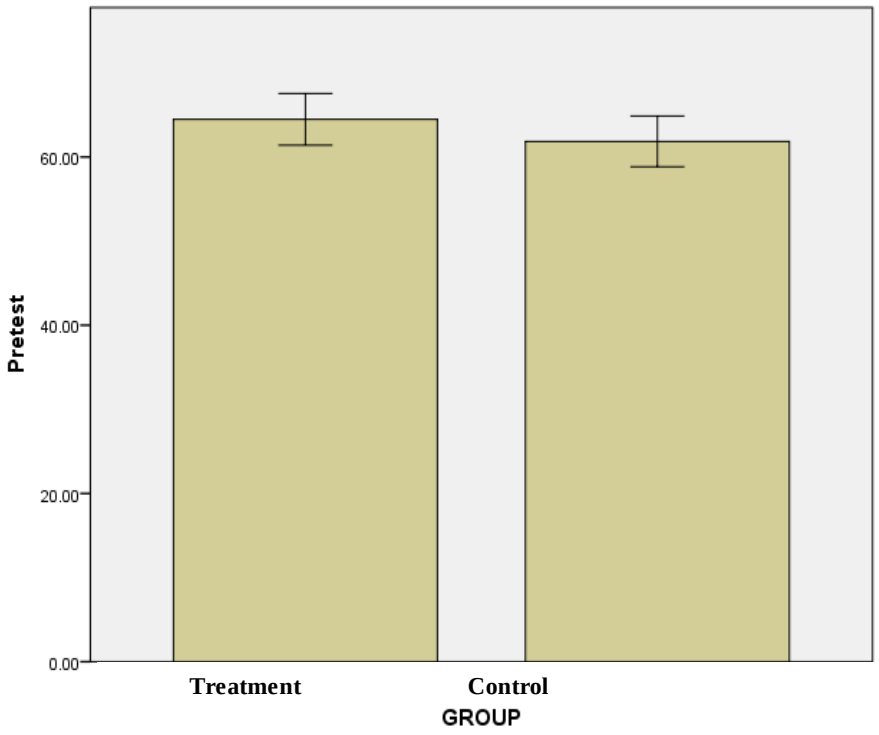

Figure 12. Independent sample t-test results.

Statistical Analysis for Research Question 1

The first research question and the hypotheses that address this study are as follows: Does the use of a script as a strategy for self-assessment in multimedia learning affect students' learning?

a) $H1_0$ - There is not a significant difference or meaningful effect size in students' learning when comparing those who use a script as a strategy for self-assessment in a multimedia learning environment, and those who do not.

b) $H1_a$ - There is a significant difference or meaningful effect size in students' learning when comparing those who use a script as a strategy for self-assessment in a multimedia learning environment, and those who do not.

To measure students' learning, the score of the second-week conceptual map, rated with the rubric (Appendix G), was subtracted from the score of the sixth-week conceptual map for each student. Figure 13 shows the frequency of the rubric scores in the pretest and posttest for control and treatment group (rubric 2 and rubric 6).

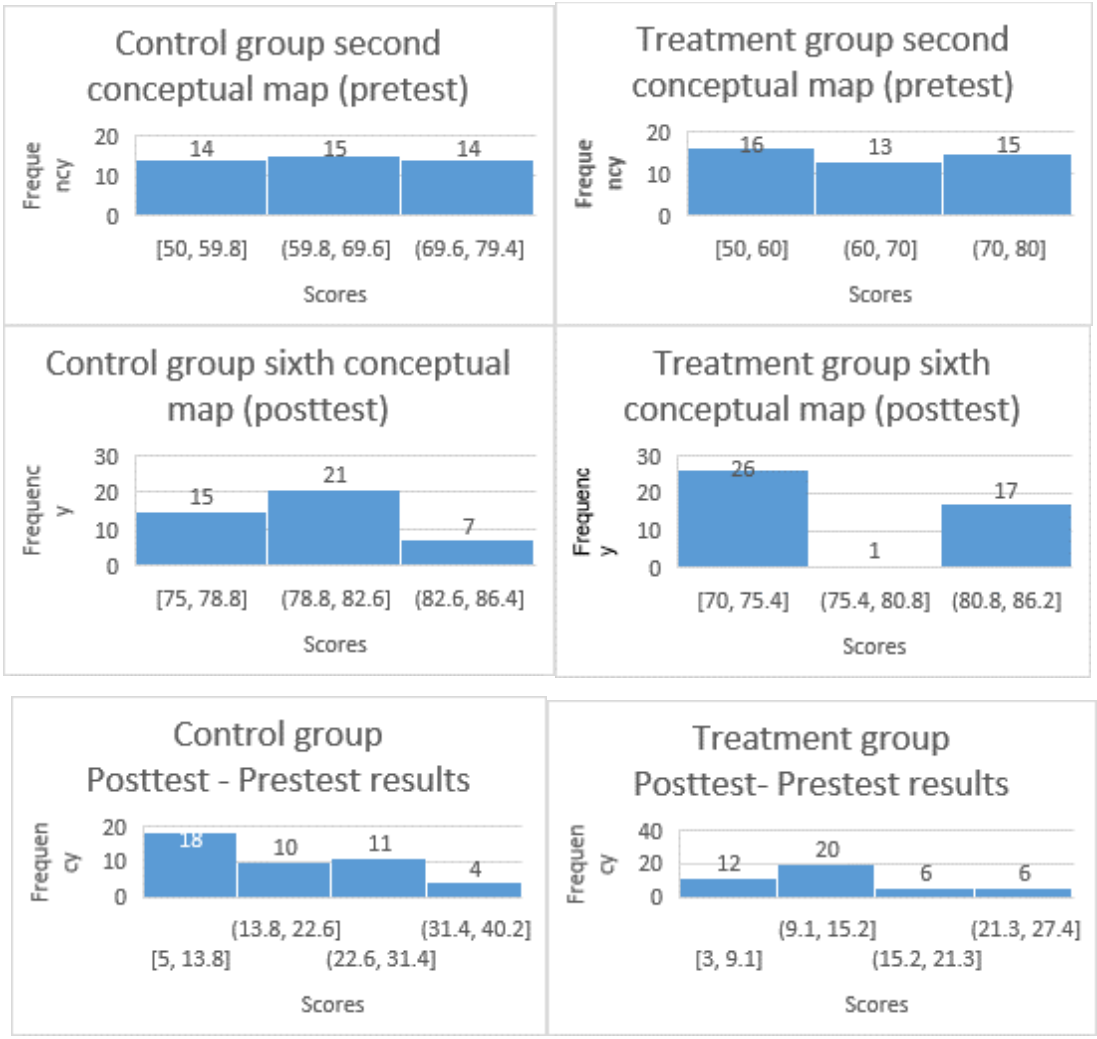

Figure 13. Rubric scores frequency for pretest and posttest for control and treatment group

The data analysis plan included multiple regression to analyze multiple moderators' variables. However, the moderator variables, teacher effect and fidelity of the implementation, were removed from the analysis because the observations process produced no results. Thus, the independent variable is the use of the script, with the moderator variables of motivation and disposition from the results of the two LEMEX

scales. An ANOVA was performed to determine the differences in mean scores between control and treatment groups using the learning measure. Multiple regression was used to determine the variables that were most significant in the learning process.

The pretest scores for the control group was (*M*=61.9, *SD*=9.8) and the treatment group was (*M*=64.5, *SD*=10.11), showing there is not a statistically significant difference, *M* = 2.6, 95% CI [-1.5, 6.8], *t* (85) = 1.2, *p* = .84, d=.26. These results showed that students in the control and treatment groups are equivalent in terms of learning. In contrast, the posttest scores for the control group was (*M*=79.6, *SD*=3.79) and the experimental group was (*M*=77.0, *SD*=5.48) showed a statistically significant difference, Welch's *F* (1, 76.6) = 6.6, *p* = .012, η^2 = .072.

One-way ANOVA was performed to determine the differences in mean scores between the control and treatment groups using the learning measure. The assumption of outlier was met as assessed by visual inspection of a boxplot (Figure 14).

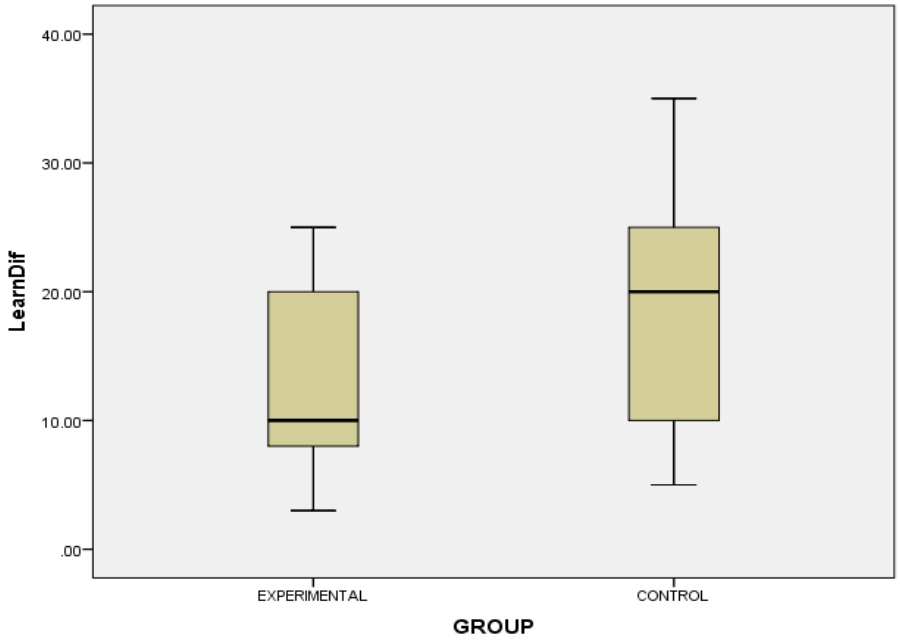

Figure 14. ANOVA results for assumption of outlier boxplot.

Note. Figure 14 shows no outliers. The normality assumption was not met. However, a one-way ANOVA was performed because it is a robust statistic for deviations from normality, particularly if the sample size is nearly equal as it is in this study.

The Learning differences were the results from the Post-test score minus the Pre-test scores. The results in the descriptive statistics showed that the difference between posttest and pretest scores was greater in the control group (n = 43, M = 18.1, SD = 8.8), than in the treatment group (n = 44, M = 12.5, SD = 6.1, Table 10).

Table 10

Difference Between Pre-test and Post-test

	N	Mean	Std. Deviation
Treatment	44	12.5682	6.16591
Control	43	18.1395	8.83063
Total	87	15.3218	8.05864

The results of the One-way ANOVA showed that there were no outliers and the data was not normally distributed for each group, as assessed by boxplot and Kolmogorov-Smirnov ($p < .05$), respectively. Homogeneity of variances was violated as assessed by Levene's test of homogeneity of variance ($p = .000$). The learning score was statistically different between groups, Welch's $F(1, 74.9) = 11.59$, $p < .05$ $\eta^2 = .121$. The learning score increased more in the control group ($n = 43$, $M = 18.1$, $SD = 8.8$) than in treatment group ($n = 44$, $M = 12.5$, $SD = 6.1$).

A multiple regression was run to predict Learning from group, disposition, and motivation. There was linearity as assessed by partial regression plots and a plot of studentized residuals against the predicted values. There was independence of residuals, as assessed by a Durbin-Watson statistic of 2.106. There was homoscedasticity, as assessed by visual inspection of a plot of studentized residuals versus unstandardized predicted values. There was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1. There were no studentized deleted residuals greater than ±3 standard deviations, no leverage values greater than 0.2, and no values for Cook's distance above 1. The assumption of normality was met, as assessed by a Q-Q Plot.

The multiple regression model summary in Table 12 shows the overall model with a correlation coefficient of *r*.369 and a coefficient of determination r^2 of .136. The adjusted r^2 is .105 meaning that 1.05 of this multiple regression model explains the variation in Learning. The effect size of .369 as Cohen (1988), suggest is moderate effect size.

Table 11

Multiple Regression Model (Learning)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.369[a]	.136	.105	7.62476	.940

Dependent Variable: LearnDif

The multiple regression model statistically significantly predicted Learning, F (3, 83) = 4.35, $p < .001$, adj. $R^2 = .136$ (Table 12). Group variable added statistically significantly to the prediction, $p < .05$, with the control group having a higher learning gain with a small effect size for multiple regression of $f^2 = .15$. The null hypothesis, there were no differences between the groups that used or did not use the script, is not rejected. Regression coefficients and standard errors can be found in Table 13.

Table 12

Multiple Regression ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	759.618	3	253.206	4.355	.007[b]
	Residual	4825.371	83	58.137		
	Total	5584.989	86			

Dependent Variable: LearnDif

Table 13

Summary of Multiple Regression Analysis

	B	SE_B	ß	VIF
Intercept	9.624	9.067		
GROUP	4.850	1.769	.303	1.171
Motivation	.568	2.059	.033	1.385
Disposition	-1.335	1.404	-.112	1.331

In summary, and contrary to what was expected in this study, the null hypothesis is not rejected.

Statistical Analysis for Research Question 2

The second research question and the hypotheses that address this study are: Is there a difference in self-regulation strategies used by students who incorporate scripts as a strategy for self-assessment in multimedia learning compared to students who do not?

1. $H2_0$ - There is not a significant difference and meaningful effect size in self-regulation strategies employed by students who use the script as a strategy for self-assessment in multimedia learning and students who do not.
2. $H2_a$ - There is a significant difference and meaningful effect size in self-regulation strategies employed by students who use the script as a strategy for self-assessment in multimedia learning and students who do not.

Several instruments for assessing self-regulation were employed. The measure of the self-regulated strategies that the students use with or without a script was two questionnaires; the Emotion and Motivation Self-Regulation Questionnaire (Appendix A) (EMSR-Q) or CMA in Spanish, (Alonso-Tapia et al., 2014) and Motivated Strategies for Learning

Questionnaire (MSLQ), (Appendix C, C-1). Both, the CMA and MSLQ questionnaires were used to assess the self-regulation dependent variable as pre- and posttest, respectively.

Self-Regulation Measures

The study used two separate questionnaires, one for the pretest and one for the posttest. The purpose of this was to compare the use of self-regulated skills between the treatment and control groups at pretest and again at posttest. There was no interest in judging if there was any change in the use of self-regulated skills in both groups. One-Way ANOVA was performed to test if groups differ in each questionnaire, as pretest and posttest. However, to test the hypothesis for the second research question, an independent samples *t* test was performed.

The first three assumptions for pretest questionnaire CMA and for the posttest questionnaire MSLQ were met for a One-Way ANOVA. The three assumptions were: variables were continuous, the independent variable is categorical with two groups, and the design had independence of observations. For the next three assumptions related to the data, a statistical test was performed using the SPSS program. The fourth assumption was assessed by inspection of a boxplot (Figure 15 and Figure 16) finding that there were no outliers.

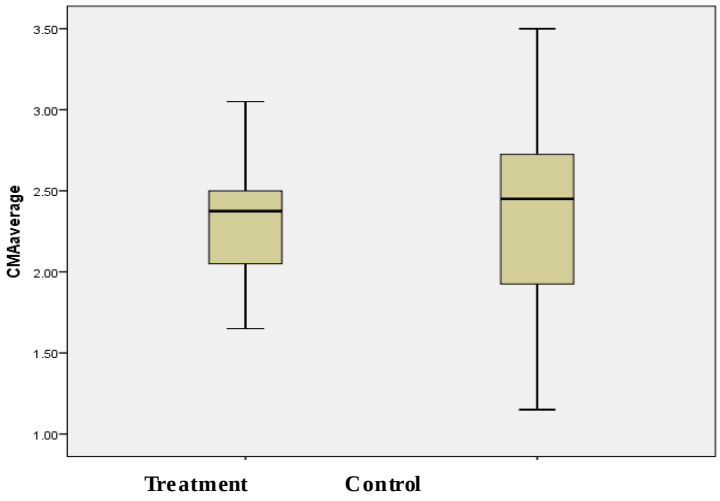

Figure 15. Boxplot of variable self-regulation (pretest) in control and treatment group sample. The figure indicates that there were no outliers.

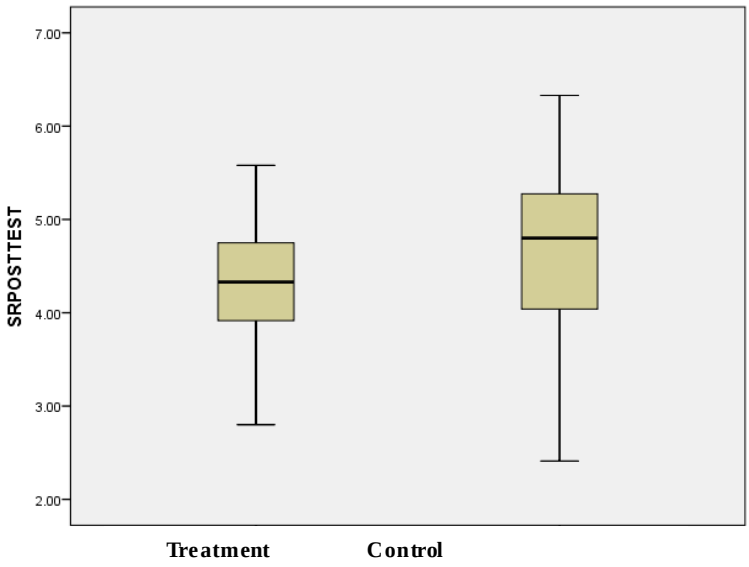

Figure 16. Boxplot of variable self-regulation (posttest) in control and experimental group sample. The figure indicates that there were no outliers.

The test for normality for CMA and MSLQ was Kolmogorov-Smirnov because the sample consisted of more than 50 subjects. For both groups, in each scale for both questionnaires, the normality assumption was met as shown in Table 14.

Table 14

Test for Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Group	Statistic	df	Sig.	Statistic	df	Sig.
CMAaverage	Treatment	.125	44	.080	.957	44	.104
	Control	.086	43	.200*	.985	43	.834
SRPOSTTEST	Treatment	.077	44	.200*	.986	44	.878
	Control	.091	43	.200*	.978	43	.586

The assumption of homogeneity of variances for the CMA questionnaire (pretest) was tested using Levene's test of equality of variances, which is but one way of determining whether the variances between groups for the dependent variable are equal. The results of this test are indicated in Table 15. The assumption of homogeneity of variances was violated, as assessed by Levene's test for equality of variances ($p = .008$).

Table 15

Test for Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
7.346	1	85	.008

A one-way Welch ANOVA was conducted to determine if self-regulation skills pretest scores in the CMA questionnaire were different for students in the control and treatment groups. There were no outliers, as assessed by boxplot; data was normally distributed for each group, as assessed by Kolmogorov-Smirnova ($p > .05$); but there was heterogeneity of variances, as assessed by Levene's test of homogeneity of variances ($p = .008$). The self-regulation pretest scores between the control and treatment groups

were not statistically different as shown in Table 16, Welch's F (1, 72.709) = .316, p = .550.

Table 16

Differences in self-regulation pretest scores

	Statistic	df1	df2	Sig.
Welch	.361	1	72.709	.550

Self-Regulation Posttest Questionnaire (MSLQ)

The assumption of homogeneity of variances was tested using Levene's test of equality of variances, which is but one way of determining whether the variances between groups for the dependent variable are equal. The results of this test are indicated in Table 17. The assumption of homogeneity of variances was violated, as assessed by Levene's test for equality of variances (p = .007).

Table 17

Homogeneity of Variances Assumption for SR Posttest (MSLQ Questionnaire)

Levene Statistic	df1	df2	Sig.
7.703	1	85	.007

A one-way Welch ANOVA was conducted for the MSLQ questionnaire results to determine if self-regulation skills posttest scores were different for students in the control and treatment groups. There were no outliers, as assessed by boxplot. Data was normally distributed for each group, as assessed by Kolmogorov-Smirnova (p > .05); but there was heterogeneity of variances, as assessed by Levene's test of homogeneity of variances (p =

.007). The self-regulation posttest score between the control and treatment groups were not statistically different as shown in Table 18, Welch's F (1, 72.641) = 2.663, p = .107.

Table 18

Differences in Self-Regulation Skills Posttest Scores

	Statistic	df1	df2	Sig.
Welch	2.663	1	72.641	.107

Independent Sample *T* Test for Self-Regulation

There were 44 participants in the treatment group and 43 participants in the control group. Participants' scores in the control group in pretest (CMA questionnaire) and posttest (MSLQ questionnaire) (M = 2.37, SD = 0.55) (M = 4.62, SD = 0.93) was higher than participants' scores in the treatment group in pretest and posttest respectively (M = 2.31, SD = 0.36) (M = 4.34, SD = 0.61) (Table 19).

Table 19

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
CMAaverage	Treatment	44	2.3182	.36823	.05551
	Control	43	2.3791	.55562	.08473
SRPOSTTEST	Treatment	44	4.3457	.61766	.09312
	Control	43	4.6233	.93347	.14235

The mean difference between groups in CMA questionnaire results (pretest) was that the control group score was -.06, 95% CI [-.26 to .14] higher than the treatment group score. In the MSLQ questionnaire results (posttest) the mean difference for control group was -.27, 95% CI [-.61 to .61] higher than the treatment group score. However,

there was not a significant difference in self-regulated skills used in pretest for control and treatment groups score, t (72.70) = -601, p= .55. Post-test scores showed no statistically significant differences between treatment and control groups, t (72.64) = -1.632, p= .107.

The purpose for using two different questionnaires was to compare the use of self-regulated skills between the treatment and control groups at pretest and again in posttest, not to compare pretest and posttest scores for individuals. The groups' mean scores were analyzed separately for both pretest and posttest with the expectation that the treatment group, after the script implementation, would show a higher use of self-regulated skills in posttest. However, for the dependent variable, self-regulated skills used by students in control and treatment groups, the differences between CMA results (pretest) and MSLQ results (posttest), showed no differences between treatment and control groups on pretest or posttest. In summary, the groups' mean in posttest was not statistically significantly different ($p > .05$), and therefore, I cannot reject the null hypothesis.

Summary

Research Question 1

An ANOVA was performed to determine the differences in mean scores between control and treatment groups using the learning measure. Multiple regression was used to determine the variables that were most significant in the learning process.

Learning score was different between groups, Welch's F (1, 74.9) = 11.59, $p <$ .05 $\eta^2 = .121$. Learning score increased more in the control group (n = 43, M = 18.1, SD =

8.8) than in the treatment group (n = 44, M = 12.5, SD = 6.1). In terms of effect size, it was a moderate effect size by Cohens recommended standard (1988) of .36. This effect size suggests that the two means differ by 0.36 times the average standard deviation of the two groups. The use of a script as an independent variable explains 3% of the variability in students' score when the effect size is .36.

However, using the confidence interval for the effect size d= .2147, CI of 95%: [-.292; .56], the results show a difference in Learning between groups with a small effect size per Cohen (1988). However, in studies such as Stegmann et al.'s (2012), significant changes were reported with an effect size of .20. According to the CI found in this study, it is possible to mention that the change is significant but small between the two groups.

While both treatment and control groups were expected to learn, the larger gain in the treatment group was expected. The explanation for this difference may be related to the differences, among groups, found in the results of the LEMEX questionnaire. The results showed that the control group has more characteristics related to the disposition towards the work than the treatment group. This is necessary to the use of self-regulation skills. These results are discussed in the next section.

A multiple regression was run to predict Learning from group, disposition, and motivation variables. The multiple regression model statistically predicted Learning with a small effect size of f^2 =.15, F (3, 83) = 4.35, p < .001, adj. R^2 = .136. Group variables added statistically significantly to the prediction, p < .05, while moderator variables, disposition and motivation did not add significance in predicting Learning, p > .05. The

coefficient of determination for the Group variable that explains the variation in Learning was R^2 = 1.68 %. The coefficient of determination for Disposition variable that explains the variation in Learning was R^2 = .20 % while for Motivation variable was R^2 = .017 %. Although the difference in Learning is determined by group, the disposition variable, R^2 = .20 %, could predict the increase in Learning scores in the control group more (n = 43, M = 18.1, SD = 8.8) than in the treatment group (n = 44, M = 12.5, SD = 6.1).

Research Question 2

The measure of the self-regulated strategies that the students use, with or without a script, was two questionnaires; the Motivated Strategies for Learning Questionnaire (MSLQ, Appendix C, Post-test) and Emotion and Motivation Self-Regulation Questionnaire (Appendix A, Pre-test) (EMSR-Q) (Alonso-Tapia et al., 2014). The purpose of this was to compare the use of self-regulated skills between the treatment and control groups at pretest and again in posttest. Since I used different tests with different scales, there was no interest in judging if there was any change in the use of self-regulated skills in both groups. Consequently, there was no interest in comparing or looking for gain between pretest and posttest scores for individuals. However, it was expected that the use of the script promoted, in the treatment group more than in the control group, the use of self-regulated skills to complete the task.

A One-Way ANOVA was performed to test if groups differ in each questionnaire, as pretest and posttest. Results shown in pretest vs. posttest scores between the control and the treatment groups were no different, $p > .05$, with a small effect size in pretest of d

= -0.13 and in posttest of d= -0.36. Also, t-test results show that both groups were not different in pretest, R^2 = .0042 and in posttest, R^2 = .03, p > .05. This implies there are no differences in self-regulation strategies between students who use scripts while working with multimedia, and students who do not. Thus, I did not reject the null hypothesis.

Chapter 5 includes a summary of the study. In addition, I present conclusions and discussions related to the findings presented in this chapter. The implications for future research, and the positive social impact of this study are presented.

Chapter 5: Discussion, Conclusions, and Recommendations

Purpose and Nature of the Study

This study addressed the effect of scripts on learning when used as a self-assessment strategy. Moreover, I investigated how this technique promotes the use of metacognitive strategies in the multimedia learning environment. The purpose of this quasi-experimental pretest/posttest control group study was to identify whether there was a difference in student learning and self-regulated skills between students who use a script as a self-assessment tool, when compared to those who do not employ this technique when working in a multimedia environment. The research objective was to analyze the effects of the self-assessment process on self-regulation when students work in multimedia contexts. Also, this study addressed the effect of the self-assessment script on student learning outcomes.

For the first research question, the independent variable was use vs. non-use of a self-assessment script. The dependent variable was learning, as measured by a rubric for the conceptual maps (Appendix G). To measure students' learning, the score of the second-week conceptual map was subtracted from the score of the sixth-week conceptual map for each student. Also, the rubrics were assessed by two independent raters, to determine the reliability of the rubric scores using Cohen's kappa statistics. An ANOVA was performed to determine the differences in mean scores between control and treatment groups using the learning measure. Multiple regression was used to determine the variables that were most significant in the learning process.

For the second research question, the independent variable was use vs. non-use of a self-assessment script. The dependent variables were self-regulation strategies by both treatment and control groups. Both groups were measured using two questionnaires, and numerical scores were generated for each questionnaire. The purpose of the pretest/posttest design was to compare the use of self-regulated skills between the treatment and control groups. Finding differences between pretest and posttest was not the purpose because I used two questionnaires with different scales. A one-way ANOVA was performed to determine whether groups differed in each questionnaire, as pretest and posttest. To test the hypothesis for the second research question, I performed an independent sample *t* test.

Interpretation of Findings

Experimental research on scripts showed that the use of different kinds of scripts enhance the quality of students' individual participation and knowledge construction, mainly when students work in computer support collaborative environment (Karakostas & Demetriadis, 2014; Noroozi et al., 2013; Papadopoulos et al., 2013; Stegmann et al., 2012). This happens while also improving the relationship between the activities process and promoting the collaboration process.

The use of a script as a self-assessment strategy to improve learning or enhance the use of self-regulated skills has been studied, and has shown positive effects using a PowerPoint presentation (Panadero et al., 2013) in a hypermedia environment (Kramarski & Michalsky, 2010), and with middle school science students (Peters & Kitsantas, 2010).

Panadero et al. (2012) conducted a study with secondary students showing that the use of a script as a self-assessment strategy resulted in better performance rates. The results of the current study contrasted with findings from previous studies.

The data collected and analyzed to answer the first research question showed a difference, Welch's F (1, 76.6) = 6.6, p = .012, η^2 = .072, between treatment and control groups. However, contrary to what was expected, the control group showed a greater increase in learning (n = 43, M = 18.1, SD = 8.8) than the treatment group (n = 44, M = 12.5, SD = 6.1). This result is consistent with findings from Raes et al. (2016), Linn and Eylon (2011), and Strijbos and Weinberger (2010) who showed no significant improvement in learning in students who used the script.

David and Boud (2016) explained one factor for these unexpected results. The researchers examined the effects of learning methods using scripts in educational learning and found that the use of scripts is also dependent on students' previous knowledge, as some of them found it hard to use scripts. Another explanation could be related to the goal orientations questionnaire (LEMEX) results. This questionnaire was used to assess equivalence between groups. It consisted of three scales to assess goal orientations: Motivation, Rejection, and Disposition. The results of the Motivation and Disposition scales were included as moderator variables because they showed differences between the treatment and control groups, with the control group showing greater motivation. Pintrich (2006) and Zimmerman (2000) pointed out that self-regulation involves motivation, scope of achievements, emotions, and will. On the other hand, Sánchez

(2011) concluded that students' motivation and learning disposition affects their academic performance. Young (2003) asserted the importance of motivation embedded in the process of nurturing self-regulated learning among learners.

These findings could be analyzed with the results of the second research question. The self-regulation pretest and posttest scores between the control and treatment groups were not statistically significantly different. An independent sample *t* test showed that in the posttest, the control group mean difference was higher than the treatment group. However, the difference was not significant enough to reject the null hypothesis. Moreover, the results of the first research question showed that students in the control group presented a greater learning gain than those in the treatment group. Nevertheless, the difference was not statically significant, thus the null hypothesis was not rejected.

Another explanation for the second research question's results could be that, as stated by Pintrich (2003) and Zimmerman (2000), the use of self-regulated skills is related to the type of task. Both researchers asserted that the use of self-regulated learning is related to how students perceive the difficulty of the task. In this sense, developing conceptual maps is an activity that needs longtime exposure for students to perform well (Novak, 2010). The timeline for data collection in the current study was only 6 weeks.

Bembenutty (2009) and James (2009) argued that a self-regulation process is highly moderated according to the academic content that influences the learning process. The context for this study was an English class, which for Puerto Rican students is their

second and more difficult language. This factor could have influenced the outcome of the study. Research in other academic disciplines is recommended.

Limitations of the Study

The greatest limitation to this study was the sampling strategy. The convenience sample did not allow for the results, even if they were significant, to be generalized to populations with the same characteristics. Another limitation was the short time assigned for the treatment, which was 6 weeks. Another weakness of the study was that quasi-experimental non-equivalent pretest/posttest control group design did not allow me to randomize the sample. The school administration formed groups prior to the study. Also, the data used to measure learning included only the conceptual maps developed by the students. In this sense, gains in learning in a specific type of evaluation limited that the results of the study could be generalized to other students' evaluation activities. In addition, I was not able to directly compare pre- and post-knowledge gain. I could only look for the differences between groups on my dependent variable measures, neither of which was a knowledge test of English. In terms of self-regulation, the use of this process is related to the activity demand and content knowledge process when students created conceptual maps. Also, the activities were in the English class; thus the results could not be generalized to other activities or to other subject contents.

Another limitation to the study was the short time of the intervention. The treatment time was just four weeks, which limited the learning of the task. It would be

interesting to determine the results with longer treatment duration, for example, the entire semester, or school year.

Furthermore, this type of design suffered from multiple threats to its internal validity such as selection bias, the history effect, the maturation effect, the mortality effect, testing, and instrumentation. These threats could have intervened in the study process affecting the results, especially in the intervention effects in the treatment groups.

Another weakness of this research is that it did not take into consideration all the processes related to self-regulation skills. As identified in the literature review, motivational factors mediate the learning process (Pintrich, 2003) as a factor of self-regulated learning. This factor was not considered as a variable in the study to analyze its effect on learning, even when significant differences were found in the motivation of the students in the control group and in the treatment group. The study only considered metacognitive factors in the self-regulation process when students work with multimedia. Regarding multimedia, this study used PowerPoint presentations. Consequently, the results of the study could not be generalized to other types of multimedia.

Finally, the questionnaires used in this study were validated and used in different populations. Only a few studies involving Hispanic people have employed these questionnaires as experimental tools, thereby limiting the results of this study.

Recommendations

The purpose of this study was to identify whether there was a difference in student learning and self-regulated skills between students who use a script as a self-

assessment tool when compared to those who do not employ this technique when working in a multimedia environment. Furthermore, the research objective was to analyze the effects of the self-assessment process on self-regulation when students work in multimedia contexts. The results showed no differences between groups and no effects. A recommendation for future studies is the need to perform more research on self-regulation strategies including variables related to this skill such as motivation, disposition, metacognition, and emotional and behavioral processes, using multimedia environments with secondary school students.

Also, future studies are necessary to understand the relationship between the self-regulation process with different academic content and students' motivation. In addition, it may be beneficial to consider different types of scaffolding that must be used as a self-assessment instrument when teachers use PowerPoint presentations and other types of multimedia.

Potential Impact for Positive Social Change

The results of this research show that self-regulation and self-evaluation are processes that must be taught in order to have positive effects, and that technology itself does not produce changes in learning. In addition, the use of scaffolds such as self-assessment scripts should be facilitated appropriately, and both the teacher and the student should learn how to use it. Equally important, teachers and students should know that this type of learning takes time. In this sense, learning the use of scaffolds and technology as a teaching process must be continuous so that the results can be seen in the

long term, and its integration is carried out according to the academic content and the technology used.

Within the educational processes, technology plays an important role in the development and delivery of educational content. Every day the use of technology increases, especially in the preparation of multimedia presentations. These presentations aim to deliver the content to the student without understanding the ways of learning and the thinking process from each one. To promote social change, it is important that the teacher uses technology. Teachers must be aware of the ways of thinking required by the student to complete tasks, both easy and complex. Even more, they should encourage the learning of these ways of thinking. Self-regulation skills can be taught (Azevedo et al., 2017; Moos & Azevedo, 2008; Greene & Azevedo, 2007), and it is important that teachers obtain information, based on research, on how to teach and integrate them when using technology as a means of learning. In addition, to use self-regulation skills in the academic process, students must learn to use them for decision making, and as a process to achieve new learning independently and in a self-directed manner.

Recommendations for Further Research

The use of a script as a self-assessment instrument did not show improvement in the learning process in this study when comparing to students who did or did not use it when learning through a multimedia environment. In addition, the use of self-regulation did not show differences in students who used it or those who did not use it. However, students in the control group obtained greater results in motivation and learning scores

than students in the treatment group. Motivation is an essential aspect in the self-regulating process (Moreno & Mayer, 2007; Mayer, 2001; Young, 2005; Pintrich, 2003). There is a need to perform more research in this area using multimedia environments with secondary school level students in Puerto Rico.

There is a lack of studies related to multimedia and the metacognition process students use when learning with multimedia. Literature on the self-regulation process shows that it is a process that must be taught (Zimmerman, 2003). Motivation is an important aspect for students to use in self-regulation strategies (Young, 2005), and to use in the self-assessment process (David & Boud, 2016). The results of this study support this argument and the importance of developing self-regulation skills. Also, there is a need to understand how students think, and what they need to improve their learning when working in a multimedia environment. Additional research is needed after developing programs to teach and learn self-regulation skills. Also, it is necessary to include other academic content, and to compare self-regulation processes in secondary school level students in Puerto Rico. Just because a teacher thinks a teaching technique using technology is beneficial doesn't mean that it actually is. The teaching practice really does need to be guided by research.

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Appendix A: Emotion and Motivation Self-Regulation Questionnaire (EMSR-Q in English)

CMA in Spanish

CMA - Cuestionario de Mensajes Autorregulatorios

Estamos tratando de entender qué pasa por la mente de los alumnos mientras trabajan con el propósito de determinar qué ayudas dar para facilitar el aprendizaje. Por eso te pedimos que señales en qué grado, mientras haces un trabajo de clase, te pasan por la cabeza pensamientos como los que aparecen a continuación. Utiliza la siguiente escala:

0	1	2	3	4
Casi nunca	Algunas veces	Ni mucho ni poco	Bastantes veces	Casi siempre

1. Esto no merece la pena. A ver si acabo pronto.	0 1 2 3 4
2. ¡Qué cansancio! Bueno, tengo que seguir si quiero aprobar.	0 1 2 3 4
3. ¡Qué estrés! Lo estoy haciendo fatal... ¡Qué difícil!	0 1 2 3 4
4. Parece que esto marcha... Me va quedando claro.	0 1 2 3 4
5. ¡Qué difícil, pero que interesante! Tengo que entender cómo se hace	0 1 2 3 4
6. Esto son ganas de hacernos perder el tiempo	0 1 2 3 4
7. Tengo que seguir, que si no lo hago no apruebo	0 1 2 3 4
8. Esto es demasiado difícil... No voy a ser capaz de hacerlo bien	0 1 2 3 4
9. Tranquilo/a... Sin prisa pero sin pausa, que me sale	0 1 2 3 4
10. Esto no está bien... Bueno... Voy a repasar despacio	0 1 2 3 4
11. ¡Vaya instrucciones más largas! Sólo sirven para liar.	0 1 2 3 4
12. ¡Qué lío! Pero venga, que si no lo termino me van a suspender	0 1 2 3 4
13. A mí esto no se me da. Si pudiera lo dejaba.	0 1 2 3 4
14. Bueno... Creo que voy progresando... Cada vez se me da mejor.	0 1 2 3 4
15. ¡Qué complicado!... Bueno, voy a seguir que es importante aprender a resolverlo	0 1 2 3 4
16. ¡Qué aburrimiento de tarea! A ver si termino y la dejo	0 1 2 3 4
17. ¡Qué tarea tan cansada!...Pero hay que aprobar... Así que seguiré	0 1 2 3 4
18. Me estoy poniendo nervioso/a... A mí esto no me sale.	0 1 2 3 4
19. ¡Qué interesante! Parece que me voy enterando.	0 1 2 3 4
20. Aquí estaba el error. Estupendo. Ya sé que hacer la próxima vez.	0 1 2 3 4

Appendix B: EMSR-Q SCALES

a) Avoidance oriented SR (α = .69)

1. This is not worth my time... Let's try to finish it as soon as possible.

6. This task is a complete loss of time!

11. What instructions so long! They only make me confused.

16. What a boring task! Let's see if I finish and leave.

b) Performance oriented SR (α = .72)

2. I'm dead tired… Well, I had to go on to pass.

7. I must go on… if I do not, I'll fail.

12. What a mess! Well… Go on… if not you won't pass the exam.

17. What a tiring task!... But I have to pass... Let's continue.

c) Negative SR of Stress (α = .79)

3. What a stressful task! I'm doing it very bad… It's so difficult!

8. This is so difficult... I am not going to be able to make it right.

13. I am not made for doing this. If I could, I would give it up.

18. I am getting nervous… I'm not able to do it.

d) Positive SR of motivation (α = .70)

4. This is going O.K.! … It seems that I understand it.

9. Calm down… "Do not hurry, do not stop" … You'll get it.

14. Well… It seems that every time I do it better… I'm progressing…

19. How interesting! It seems to me that I understand it.

e) Process oriented SR (α = .70)

5. How difficult, but how interesting! ... I have to understand how to do it.

10. This is not right…I'm going to check it step by step.

15. How complicated!... Well, I'll go on... it is important to learn how to solve it.

20. Here was the mistake! Great! Next time I will know how to do it

Appendix C: MSLQ Questionnaire English

The following questions ask about your learning strategies and study skills for this class. Again, there are no right or wrong answers. Answer the questions about how you study in this class as accurately as possible. Use the same scale to answer the remaining questions. If you think the statement is very true of you, circle 7; if a statement is not at all true of you, circle 1. If the statement is more or less true of you, find the number between 1 and 7 that best describes you.

1	2	3	4	5	6	7
not at all true of me						very true of me

Item

33. During class time I often miss important points because I'm thinking of other things. (REVERSED)
36. When reading for this course, I make up questions to help focus my reading.
41. When I become confused about something I'm reading for this class, I go back and try to figure it out.
44. If course materials are difficult to understand, I change the way I read the material.
54. Before I study new course material thoroughly, I often skim it to see how it is organized.
55. I ask myself questions to make sure I understand the material I have been studying in this class.
56. I try to change the way I study in order to fit the course requirements and instructor's teaching style.
57. I often find that I have been reading for class but don't know what it was all about. (REVERSED)
61. I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying.
76. When studying for this course I try to determine which concepts I don't understand well.
78. When I study for this class, I set goals for myself in order to direct my activities in each study period.
79. If I get confused taking notes in class, I make sure I sort it out afterwards.

Appendix C-1: MSLQ Questionnaire (Spanish)

Las siguientes aseveraciones preguntan sobre sus estrategias de aprendizaje y sus destrezas de estudio para esta clase. Nuevamente, no hay correctas o incorrectas. Conteste las preguntas sobre como usted estudia para esta clase con la mayor exactitud posible. Usa la siguiente escala para contestar las preguntas. Si usted entiende que la aseveración es muy cierta, cerca el # 7; si la aseveración no es del todo cierta para usted, cerca el 1. Si la aseveración es más o menos cierta para usted, encuentre un número entre el 1 y el 7 que mejor lo describa a usted.

1 2 3 4 5 6 7
No del todo cierto muy cierto para mí

33. Durante la clase, frecuentemente se me pasan puntos importantes debido a que me pongo a pensar en otras cosas.

1 2 3 4 5 6 7
No del todo cierto muy cierto para mí

36. Cuando leo para este curso, Me hago preguntas para ayudar a enfocarme en la lectura.

1 2 3 4 5 6 7
No del todo cierto muy cierto para mí

41. Cuando me confundo con algo de lo que estoy leyendo para esta clase, vuelvo atrás a la lectura e intento descifrarla.

1 2 3 4 5 6 7
No del todo cierto muy cierto para mí

44. Si los materiales del curso son difíciles de entender, cambio la manera en la que leo el material.

1 2 3 4 5 6 7
No del todo cierto muy cierto para mí

55. Me hago preguntas para asegurarme que entiendo el material que he estado estudiando en clase.

1 2 3 4 5 6 7
No del todo cierto muy cierto para mí

54. Antes de estudiar el nuevo material de curso meticulosamente, frecuentemente ojeo el material para ver cómo está organizado.

1 2 3 4 5 6 7
No del todo cierto muy cierto para mí

56. Trato de cambiar la manera en la que estudio para poder cumplir con los requisitos y estilo de enseñanza del instructor.

1 2 3 4 5 6 7

No del todo cierto muy cierto para mí

57. Mayormente descubro que he estado leyendo para la clase, pero no sé de qué trata lo que leí.

1 2 3 4 5 6 7

No del todo cierto muy cierto para mí

61. Trato de pensar cuando estoy trabajando con un tema y decidir que se supone que sea lo que aprenda de el en lugar de tan solo leerlo una y otra vez cuando estudio.

1 2 3 4 5 6 7

No del todo cierto muy cierto para mí

76. Cuando estudio para este curso trato de determinar cuáles conceptos no entiendo muy bien.

1 2 3 4 5 6 7

No del todo cierto muy cierto para mí

78. Cuando yo estudio para esta clase, me propongo metas para dirigir mis actividades en cada periodo de estudio.

1 2 3 4 5 6 7

No del todo cierto muy cierto para mí

79. Si me confundo tomando notas en clase, me aseguro de solucionarlo después

1 2 3 4 5 6 7

No del todo cierto muy cierto para mí

Appendix D: Motivation and Expectations of Learning Questionnaire

LEMEX Questionnaire

Below you will find a series of affirmations about yourself with which you can be more or less in agreement. In the answer sheet choose the option that represents your degree of agreement with the content of the statement, according to the following scale

1 Totally disagree	2 Somewhat disagree	3 Indifferent	4 Strongly Agree	5 Totally agree

3. If I reach a goal, I usually set myself a harder one to accomplish.

8. I'm not one of those people who are constantly studying because I believe there are other things to be done.

10. When I have to evaluate my work I pay more attention to the progress I've made instead of asking myself if other people's progress is better or worse than mine.

11. To be precise, I'd have to say that normally I take on more work that seems reasonable to accept.

14. If I have managed to finish a task correctly, I think about the weight taken off my shoulders instead of thinking about developing new projects.

17. If I could choose, I'd rather work with creative works in which could learn even when it means earning less money.

20. If a job takes too much effort to finish it I try not to overdo it, I'll settle for an acceptable performance

23. If I could choose I'd pick easy tasks to not complicate my life.

28. I frequently find myself thinking about how to solve problems just because of the challenge they present, although it doesn't affect me.

31. I don't know how I manage, but my preoccupations won't give me a break.

34. I'm not one of those who always try to face new challenges because I rather do what I already know.

38. I don't dislike that much when something goes wrong because mistakes are normal and I tend to learn from them.

41. I don't care if people think I'm lazy, I work at my own rhythm which is what I'm supposed to do.

44. When I'm doing something and come out wrong, I tend to do something else because I don't like to waste time and complicate my life.

49. I don't dislike that others negatively evaluate what I do as long as they give me ideas of how to do a better job.

52. I frequently make myself responsible for more tasks that I can normally take on.

55. If I know enough to do my job I won't make an effort to be better because there are other things in life to spend my time in.

59. If I do something right, I like to review the steps to remember how I did it and be able to do it a next time.

61. I often pay little interest at a job because I believe that is lacking utility when providing valuable experience or knowledge.

64. When I study or work I tend to make an average effort because I believe we have to save energy.

70. If a task has come out right I'll start working in something else and won't think about the task anymore.

71. Generally, what I learn while I study and do my job proves to be very useful, hence I show great interest in it.

76. If it wasn't for the fact that I have to make a living, I wouldn't work because I see that most of the things to study for or do are worthless.

79. When I have the most fun at my work is when I have to solve problems that are new to me.

80. I'm not one of those who only do the minimum; I make an effort to get the best out of every experience because to me everything is useful.

83. In terms of working, I believe there are few people who are as busy as I am

91. In my workplace I like easy tasks that won't cause me difficulties.

92. Even when I make an effort, it is very hard for me to find something positive from my studies or work; therefore, I am normally wishing to finish them.

95. The biggest satisfactions I have received in my job are due to the fact of solving difficult problems.

96. I work not only regularly but punctual because I find it nice to prove that everything is useful and can show me something.

98. I don't like jobs that force me to make an effort in a continuous way; I rather change to something else and not get tired.

106. If I finish a difficult problem, the thing that satisfies me the most is having finished it and not having to spend more time on it.

107. Working and studying are so boring that most of the time I find myself wishing to get it over with, so I can do other things.

110. When something goes wrong, I don't mind asking for help as long as I learn and even when someone might think that I'm incompetent.

111. In general, work and studies seem gratifying because of what is being taught making me work with more interest.

114. If I have nothing to do, I'll look for an occupation because I don't like to waste time.

122. When I finish a work I value more the fact of finishing it instead of what I could learn by completing it.

123. In general, not seeing the purpose/utility and interest of most jobs makes me wonder about starting the task and working effortlessly.

125. Normally, the activities that I must do while I work provide useful experiences which do not make me rush through them.

127. When I work I'm not one of those who fully concentrate, I frequently tend to get distracted.

134. If I have to choose between having to work or have fun, I rather do the second one.

138. It would be preferable for me to have more days of vacation than work days.

139. It can honestly be said that I am a person that works more than the majority.

147. When I must study or work with something that has a clear utility, I won't skimp in making an effort.

149. When I start a job, whatever it is I'm looking for is to get rid of it as soon as possible

155. It is very frequent for me to start things that I never finish.

156. To be honest, if someone looks for me they will probably find me working.

164. I wish I didn't have to work.

165. If I have to, I don't mind taking work home because I always like to keep myself busy.

178. I agree with those who think I work too much.

Appendix D-1: Motivation and Expectations of Learning Questionnaire in Spanish

LEMEX Questionnaire (Spanish)

Instrucciones: A continuación, encontrarás una serie de afirmaciones sobre ti mismo con las que puedes estar más o menos de acuerdo. En la hoja de respuesta elige la opción que representa tu grado de acuerdo con el contenido de la afirmación según la siguiente escala.

1 Totalmente en desacuerdo	2 Bastante en desacuerdo	3 Indiferente	4 Bastante de acuerdo	5 Totalmente de acuerdo

3. Si alcanzo una meta, normalmente me propongo lograr otra más difícil.

8. No soy de los que están continuamente estudiando porque creo que hay que hacer también otras cosas

10. A la hora de evaluar mi trabajo me fijo más en si he progresado que en si es mejor o peor que el de otras personas.

11. Para ser exacto hay que decir que normalmente asumo más trabajo que lo que parece razonable aceptar.

14. Si he conseguido hacer bien una tarea, pienso en el peso que me he quitado de encima más que en desarrollar nuevos proyectos.

17. Pudiendo elegir, prefiero los trabajos creativos y en los que puedo aprender, aunque gane menos dinero.

20. Si un trabajo cuesta mucho terminarlo, procuro no matarme a trabajar, hasta que quede pasable.

23. Si me dan a elegir, procure las tareas fáciles con las que no tengo que complicarme la vida.

28. Es frecuente que me encuentre pensando en cómo resolver problemas por el reto que suponen, aunque no me afecten.

31. No sé cómo me las arreglo, pero mis ocupaciones no me dejan un rato libre.

34. No soy de los que tratan siempre de afrontar nuevos retos porque prefiero hacer lo que se.

38. No me desagrada demasiado que algo me salga mal, porque los errores son algo natural y procure aprender de ellos.

41. Me da igual que piensen que soy perezoso, porque yo voy a mi ritmo que es lo que hay que hacer.

44. Cuando algo me sale mal procure cambiar de tarea porque no me gusta perder el tiempo complicándome la vida.

49. No me desagrada que otros evalúen negativamente lo que hago con tal que me den ideas sobre cómo hacerlo mejor.

52. Con frecuencia me responsabilizo de mis tareas más de las que normalmente se pueden abarcar.

55. Si se lo suficiente para hacer mi trabajo, no me esfuerzo en mejorar porque en la vida hay otras cosas a las que dedicar el tiempo.

59. Si algo me sale bien, me gusta repasar como lo he hecho, para que no se me olvide y poderlo hacer bien en otra ocasión.

61. A menudo pongo poco interés en el trabajo porque creo que su utilidad para aportarme experiencia o conocimientos valiosos es escasa.

64. Cuando estudio o trabajo, suelo esforzarme lo justo, porque creo que hay que economizar energías.

70. Si una tarea me ha salido bien, paso a hacer otra y no vuelvo a pensar en ella.

71. Por lo general, lo que aprendo estudiando y hacienda mi trabajo me resulta muy útil, por lo que pongo gran interés en ello.

76. Si no fuese porque hay que ganarse la vida, no trabajaría porque no veo que la mayoría de las cosas que hay que estudiar o hacer valgan

79. Cuando más disfruto en mi trabajo es cuando tengo que resolver problemas que resultan nuevos para mí.

80. Yo no soy de los que hacen solo lo imprescindible, sino que me esfuerzo de aprovechar toda experiencia porque todo es útil.

83. Si de trabajar se trata, creo que hay pocas personas que estén tan ocupadas como yo, que ya me paso.

91. En mi trabajo me gusta sobre todo que las tareas sean fáciles y no me cree dificultades.

92. Aunque me esfuerce, me resulta difícil sacar algo positive del estudio o del trabajo, por lo que normalmente estoy deseando terminar.

95. Las mayores satisfacciones que he recibido en mi trabajo me las ha procurado el haber sido capaz de solucionar problemas difíciles.

96. Trabajo con regularidad y no solo puntualmente porque me resulta agradable comprobar que todo tiene su utilidad y me puede enseñar.

98. No me gustan los trabajos que me obligan a esforzarme de modo continuado: prefiero cambiar para no cansarme.

106. Si termino un problema difícil, me satisfice más el hecho de haber terminado y no tener que dedicarle más tiempo que cualquier otra cosa.

107. Es tan aburrido el trabajo como el estudio que casi siempre estoy deseando terminar para poder dedicarme a otras cosas.

110. Cuando algo me sale mal, no me importa pedir ayuda con tal de aprender, aunque alguien pueda pensar que soy un inepto.

111. En general el trabajo y el estudio me resultan gratificantes por lo que me enseñan y eso hace que trabaje con interés.

114. Si no tengo nada que hacer me busco alguna ocupación, porque no me gusta perder el tiempo.

122. Cuando termino un trabajo valoro más el haberme quitado una tarea de encima que lo que pueda haber conseguido haciéndola.

123. En general, no ver la utilidad y el interés de la mayoría de los trabajos hace me cueste ponerme a la tarea y que trabaje con desgano.

125. Normalmente, las actividades que he de hacer al trabajar me aportan experiencias útiles, lo que hace que no tenga prisa por terminar.

127. Cuando trabajo no soy de los que se concentran al máximo: suelo distraerme fácilmente.

134. Si tengo que escoger entre trabajar y divertirme, prefiero lo segundo.

138. Para mí sería preferible que hubieran más días de vacaciones y menos de trabajo.

139. Puede decirse con verdad que soy doy una persona que trabaja más de los que trabaja la mayoría.

147. Cuando he de hacer un trabajo o estudiar algo que tiene una clara utilidad, no escatimo el esfuerzo.

149. Cuando empiezo un trabajo, sea el que sea, lo que busco es quitármelo de encima cuanto antes.

155. Es frecuente que empiece cosas que después no termino.

156. La verdad es que, si alguien me busca, lo más probable es que me encuentre trabajando.

164. Me gustaría no tener que trabajar.

165. Si hace falta, no me importa llevarme trabajo a casa porque me gusta estar siempre ocupado.

178. Estoy de acuerdo con quienes piensan que trabajo demasiado.

Appendix E: LEMEX Scale

To obtain scores in each scale, add the score in each item after inverting scores in those preceded by the minus (-) sign. In these items, if 5→1, if 4→2, if 3→3, if 2→4, if 1→5.

Motivación por aprender

3+	8-	10+	14-	17+	23-	28+	34-	38+	44-
49+	55-	59-	70-	79+	91-	95+	106-	110+	122-

Disposición al esfuerzo

11+	20-	31+	41-	52+	64-	83+	98-	114+	127-
139+	149-	156+	165+	178+					

Desinterés por el trabajo y rechazo del mismo por no ver su utilidad

61+	71-	76+	80-	92+	96-	107+	111-	123+	125-
134+	138+	147-	155+	164+					

Appendix F: Self-Assessment Script for Conceptual Map Development

Self-assessment script is a set of questions that will help you on the process of developing and creating the conceptual map from start to finish it. Use the script each time that you are working developing a conceptual map.

- Are you clear with all the elements, conceptual and of physical structure which should be included in the conceptual map?
- Are you clear about what you should be include in the conceptual map?
- Shall I include another concept?
- Shall I modify a concept or take it out?
- Have I organized the concept correctly?
- Have I forgotten any connector word?
- What relationship could be between different concepts?
- Would it be good including examples?
- Are all my works free of grammatical, spelling or writing errors?
- Is the conceptual map easy to understand?

Apéndice F-1 (Spanish): Guion de autoevaluación para desarrollar un mapa conceptual

El guion de autoevaluación es un conjunto de preguntas que le ayudarán en el proceso de desarrollo y la creación su mapa de conceptos de principio a fin. Utilice la secuencia de comandos cada vez que se está trabajando con mapa de conceptos.

- ¿Estas claro con todos los elementos, conceptuales y de estructura física que deben estar incluidos en el mapa conceptual?
- ¿Estas claro sobre lo que debe incluirse en el mapa conceptual?
- ¿Yo debería incluir otro concepto?
- ¿Yo debo modificar un concepto o debo excluirlo?
- ¿Tengo organizado el concepto correctamente?
- ¿He olvidado alguna palabra conectora?
- ¿Qué relaciones deben estar entre los diferentes conceptos?
- ¿Sería bueno incluir ejemplos?
- ¿Está todo mi trabajo libre de errores gramaticales, de ortografía o de escritura??
- ¿Está el mapa conceptual fácil de entender?

Appendix G: Rubric for Conceptual Map

Score / Assesment criteria	4	3	2	1
Concepts	All the critical and secondary ideas are included	Includes the critical ideas and few secondary concepts but not all	The important ideas are included but not the secondary ones	Some essential concepts are deficient
Hierarchy	The construction is finalized and precise and the map communicates it	The construction is correct but unfinished: some levels or elements are deficient	The construction is finalized but incorrect: there are ideas in the wrong places	The construction is unfinished and incorrect
Relationships among concepts in different hierarchical levels	**Relationships:** There is accurate making linkage among the correct concepts **Connector words** Explicit and help to better comprehend the relationships among concepts	**Relationships:** There are accurate but incomplete: some links are lacking **Connector words** Unfinished: Only some are explicit, but they are correct	**Relationships:** Some are incorrect making linkage among concepts that do not have any interrelation **Connector words** Only some are explicit, but some are incorrect	**Relationships:** The majority are incorrect or there are only a few **Connector words** Unfinished and incorrect
Relationships among concepts from different columns	There are all connections making important relationships	There are various connections making important relationships	There is only one	None
Simplicity and easiness of understanding	Its composition is simple and easily comprehensible. There are examples	Few relationships are difficult to understand. Contains a few examples	There is an overdone number of links. There are no examples	Neither the relationships or the hierarchy are comprehensible. There are no examples.

Taken and adapted with author authorization from: Panadero, E. & Alonso-Tapia, J. (2013).

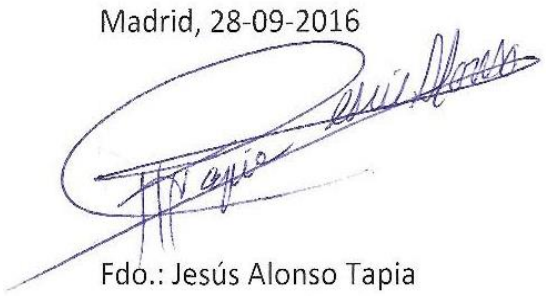
Appendix H: Questionnaires Authorization

UAM
UNIVERSIDAD AUTONOMA
DE MADRID

JESUS ALONSO TAPIA, professor at the Autonomous University of Madrid and author of

MAPEX principal (LEMEX in Spanish), CMA and EMSQR questionnaires, authorizes GUILLERMINA VIRUET, doctoral student from Walden University in Educational Technology, to use these questionnaires in her doctoral dissertation.

Madrid, 28-09-2016



Fdo.: Jesús Alonso Tapia

Appendix I: Observation Checklist

Teacher: _____
Date: _____

Observation Rating Guide

2= Present and correct 1= Present, but not following the procedure 0= Missing or incorrect

Script Implementation (Treatment group)				
Rating	Teacher	Rating	Student	comments
	Teacher modelling the use of script as design		Students acknowledge the expectations and get ready	
	Teachers' recall about use of script as design		Students use the script while working with the conceptual map	
Time class procedure (Control and treatment group))				
Rating	Teacher	Rating	Students	comments
	Tell students what they will do and what's expected the same way to both groups.		Students acknowledge the expectations and get ready	
	Teacher show the multimedia about how to create a conceptual map using the procedure time as design		Students use the allotted time for created the conceptual map without script	
	Teacher show multimedia about the English class week summary as design		Students use the allotted time for created the conceptual map with script	
	The time for the procedure is the same as previous		The time for the procedure is the same as previous	