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## Model evidence links (MELs) and the impact of critical thinking on open ended responses

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MODEL EVIDENCE LINKS (MELS) AND THE IMPACT OF CRITICAL THINKING  
ON OPEN ENDED RESPONSES

An Abstract of a Dissertation  
Submitted  
in Partial Fulfillment  
of the Requirements for the Degree  
Doctor of Education

Approved:

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Dr. Benjamin Forsyth, Chair

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Dr. Jennifer Waldron  
Dean of the Graduate College

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University of Northern Iowa

July 2021

## ABSTRACT

The purpose of this dissertation, which was conducted in a rural school district that is equidistant from three major urban areas in central Iowa, and employed an action research methodology, was to examine the relationship between graphic organizer use and critical thinking. A multitude of studies have provided evidence that graphic organizers aid in the recall and understanding of basic facts in the lower grade levels; however, little research exists that supports a connection between graphic organizer use and the ability of students to recall information used on open-ended critical thinking assessments or the ability to create what Bickel and Lombardi (2016) call “causal connections” with content material. This study examined a research-based method that can deliver consistent results in growing students’ understanding of social studies content, while allowing students to interrogate content and demonstrate knowledge of critical thinking skills through an open-ended written response.

This dissertation was based on an action research methodology in which the researcher conducted the dissertation within his secondary social studies classroom. The students who participated in this study were members of two different courses, divided into two sections of each course according to their class schedule determined by the high school counselor. Students were engaged in instruction using research based instructional methods, in coordination with the three, twenty minute blocks per week of direct MEL instruction. Students were measured on growth in critical thinking skills on open-ended critical thinking writing prompts. The growth of students measured using a rubric,

allowed for isolation of specific critical thinking skills that were specifically targeted with MEL usage and instruction.

These results suggest that MELs are an effective tool for promoting critical thinking and potentially other higher levels of learning. The positive impact of MELs, may be found in multiple subject areas including social studies. Implications for incorporating the use of MELs into classroom instruction are discussed, as well as broader theoretical implications for critical thinking that involves cognitive models and evidence.

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Dr. Dr. Benjamin Forsyth, Chair

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James Gregory Zabel  
University of Northern Iowa  
July 2021

## DEDICATION

The work of this dissertation is dedicated to all of those who helped me along the way, especially my wife, Jessica, and my daughter, Lily. Without their support none of this would be possible.

## ACKNOWLEDGEMENTS

I would also like to thank the Baxter High School classes of 2019 and 2022 for their willingness to be open-minded in my approach to instruction. Finally, I want to thank my dissertation chair, Dr. Benjamin Forsyth for the multitude of hours spent working with me on this action research project.



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## CHAPTER 1

### INTRODUCTION

#### Purpose

The purpose of this dissertation, which employed an action research methodology, was to examine the relationship between graphic organizer use and critical thinking. A multitude of studies have proven that graphic organizers aid in the recall and understanding of basic facts in the lower grade levels; however, little research exists that supports a connection between graphic organizer use and the ability of students to recall information used on open-ended critical thinking assessments or the ability to create what Bickel and Lombardi (2016) call “causal connections” with content material. This study focused on expanding Lombardi’s graphic organizer work. The study involved students in secondary school. Within these groups, variables such as instructional time, student use, and student assessments were used to determine the impact a particular kind of graphic organizer, called a Model-Evidence Link, had on the formation of critical thinking skills and within the knowledge domain of social science instruction. Mainly, this study was conducted to determine, if, and how MELs extend the typical use of graphic organizers for understanding material (basic recall and the storing of important, though low-level, factual evidence) as vehicles that can improve higher level thinking skills and behaviors such as critical thinking and open-ended reasoning via the use of causal diagrams.

As research states, the use of graphic organizers has been explored in multiple studies; however, the idea of expanding MELs to the realm of social studies has yet to be

done. According to Rinehart et al. (2014), “Holding students accountable is key. The criteria lists for model quality, evidence quality, and strong arguments can easily be turned into rubrics that provide a constant reminder to students of what they should attend to in their reasoning and writing” (p. 75). The difference between the traditional graphic organizers such as mind webs, flow charts, and other basic organizers and MELs is the requirement of students to explore and analyze criteria specific to learning targets and content standards. The criteria explored by students assist in the scaffolding of knowledge within a specific learning target, lesson, or content standard (Bickel & Lombardi, 2016).

Critical thinking is an important factor in this action research study. According to Greene and Yu (2015), critical thinking is attributed more to the understanding of content knowledge and the ability to interact with it, than the measurement of intelligence. It is best described as the ability to analyze and explore new content in either a novice or expert fashion. The ability to use previously acquired skills, knowledge, and experience to interact in a critical way with new content and evidence is a key connecting factor between critical thinking and MEL use (Lombardi et al., 2017). To target the impact of MEL usage and critical thinking skill acquisition, this study was conducted using the action research framework. In this action research study, the researcher was also the teacher of the students in the study. It was conducted in the researcher’s classroom with four of the researcher’s six classes within the framework of a traditional semester schedule with forty-two minute class periods. Through this process, the action research

study focused on the acquisition of critical thinking skills in coordination with MEL use in analyzing student ability to respond to open-ended writing prompts.

### Contextual Factors

The setting for this study was a rural school district that is equidistant from three major urban areas in central Iowa. The district as a whole is made up predominantly of Caucasian students (97%), the majority of whom fall into either the upper middle social class or the lower class, with several families living at or below the poverty line. With this stated, the town has been referred to as a “Bedroom Community,” with the majority of parents working outside of the community. What this has caused, in the district, is a student population that is over-represented in both the upper middle class and the lower class, meaning there are very few students who fall in the same social class (middle) as their teachers. The majority of teachers in the district also reside outside of the district. In terms of the physical building, grades Kindergarten through twelfth grade attended the same building, meaning some students have spent their entire educational life in the same space. It allowed for great opportunities in mentoring, positive behavioral supports, and alignment of curriculum between elementary, middle, and high school. Unfortunately, it also meant that students are subjected to the same teachers, especially in middle and high schools, because most of the departments are less than two people. The only exception being the English-Language Arts, which has four teachers. Oftentimes, students are taught in the same manner and with the same teaching materials year after year. While this can be seen as positive, especially in classrooms headed by highly experienced and



effective teachers, it also binds students to ineffective and relatively inexperienced teachers.

With the idea of having repetitive teachers and repetitive experiences, students are often stifled in terms of exposure to instruction types and expectations for assessment. Students, in the district, are often exposed to the age-old strategy of drill and practice; however, what this has taught students, and teachers for that matter, is how to play the game of resuscitation or memorization; something this researcher refers to as “sponge and puke.” While this method has been the measurable “norm” for standardized tests throughout the past century, it has done little to enhance the ability of students to think critically or develop skills in problem-solving or critical thinking skills. Through the use of Professional Development, teachers started, especially within the past three years, to be challenged to create and develop instruction and assessment that is aimed at building critical thinking and problem-solving skills. However, the struggle has been real in terms of moving students to a different way of thinking and preparing for critical thinking based open-ended written response assessments. Not only was the instruction aimed at improving critical thinking and problem-solving skills, but it also exposed students to educational aids, such as graphic organizers, specifically Model Evidence Link (MELs) (Bickel & Lombardi, 2016), to enhance the acquisition of these skills and knowledge sets.

### The Problem

Students and teachers alike have a common understanding of what it means to think critically (Passmore, 1967); however, the most common understanding of this activity is finding creative ways to express newly acquired knowledge or to think

“outside the box” in solving some kind of real-world problem (Murawski, 2014). While many teachers and students think they have an understanding of what it means to think critically, many teachers are missing the essential instructional tool or experiences to truly teach their students the skills needed to be critical thinkers and problem solvers (Ennis, 2011). In classrooms, especially at the secondary level, it is presumed that students have an understanding of how to research, analyze, and use specific evidences to support their learning. In all honesty, research tells us this is not the case. Students need to be instructed on appropriate ways to engage with evidence and materials that require a deeper level of understanding. This is missing in most secondary classrooms (Mastropieri et al., 2003). However, the research conducted in this study aims to support the idea of specific and deliberate instruction of these thinking and evidentiary skills in the improvement of student thinking.

While conducting research on the effectiveness of the use of graphic organizers in secondary classrooms, as a tool for students' understanding and later recall on assessments, especially standardized tests, it is apparent that very little research has been conducted on the effectiveness of graphic organizers at the secondary level (Mastropieri et al., 2003). However, much research has been done at the elementary level confirming the use of graphic organizers as effective teaching tools, especially in terms of student understanding and retention (Key et al., 2010). With the research backing the effectiveness of graphic organizers at the elementary level, it can be thought that these findings can be related to the secondary level (Reagan, 2008). However, very little research has been done at the secondary level, thus the study of graphic organizer

effectiveness on retention and understanding, especially in terms of standardized tests, is essential.

Student exposure to graphic organizers often begins as early as Kindergarten, with simple concepts such as comparing and contrasting the seasons and becoming more regularly used in upper elementary (Reagan, 2008). Oftentimes, this is where the regular exposure to graphic organizers ends, meaning there is a gap in the usage of graphic organizers between upper elementary grades and the beginning of high school (Weisman & Hanson, 2007). According to Reagan (2008), students in the fifth grade are pseudo familiar with the concept of graphic organizers, mainly in the concept of mind webs and brainstorming. Reagan (2008) argues it is important to review the ideas and concepts involved in graphic organizers in order to build on prior knowledge on the students and expand the amount of material presented and difficulty of concepts discussed (Key et al., 2010).

The use of graphic organizers as an educational aid at the secondary level is oftentimes underutilized (Doyle, 1999). With the poor use of these types of educational aids, students are missing the chance to take full advantage of a helpful study strategy. Cases of overuse of graphic organizers are also evident at the secondary level (Gallavan & Kottler, 2007). This can create situations where teachers use graphic organizers on a daily basis but do not reap their full benefit. For example, a Cloze style note graphic organizer, which looks similar to a fill in the blank test or quiz put up on a projector or PowerPoint, is used by students to fill in key missing words on a note sheet presented by a teacher. Fordham et al. (2002) found that using the Cloze style notes every day can

reduce its effectiveness as students may get bored with the activity and cease to pay attention. Varying the type and frequency of graphic organizers is a much more effective strategy for improving student retention of facts. However, Fordham et al., (2002) do not focus on how their graphic organizers affected higher level cognitive processing like critical thinking, which is the main thrust of this study.

Lombardi et al. (2017), introduced a particular kind of graphic organizer called Model-Evidence Link (MEL) diagrams to teach students conceptual content that connects socio-scientific, complex, and abstract issues. MELs help students to scaffold content in a way that facilitates weighing and coordinating connections between evidence and an associated model for explaining a particular phenomenon. The inclusion of MELs in secondary classrooms expands the possibilities of what graphic organizers are capable of providing high-level thinking skills (Lombardi et al., 2017). Research suggests that MELs contribute to students developing critical thinking skills. Lombardi suggests that these skills are essential to student achievement and the ability to demonstrate mastery of a given skill set.

According to Rinehart et al. (2014), “Holding students accountable to scientific reasoning is key. The criteria lists for model quality, evidence quality, and strong arguments can easily be turned into rubrics that provide a constant reminder to students of what they should attend to in their reasoning and writing” (p. 75). This statement supports the purported importance of students being assessed through an open-ended assessment question to identify growth directly related to the use of MELs.

Rinehart et al. (2014) also argue, “To help students develop facility with discerning good evidence from bad evidence, we suggest using a wide range of evidence so that students have the opportunity to use their evidence-quality criteria” (p. 74). This seems as valid for the hard sciences as for the social sciences. The ability to make educated and informed decisions, especially when presented with a massive amount of evidence in social studies is a difficult task. Nevertheless, like science, it is essential for students to learn to understand the process of identifying evidence, which is a purported major function of MELs. For this reason, Rinehart and colleagues (2014) agree with Bickel and Lombardi (2016) in terms of MELs leading to stronger connectivity between content and student assessment scores.

#### Impact of Critical Thinking on Instruction

In terms of understanding the impact of the development of critical thinking skills, it is important to understand the difference between the ability to think with a critical viewpoint of a specific topic given specific evidence and the ability to simply understand the topic on a general level. This forces students to actively engage with evidence and examine or analyze information for what specifically helps them to answer an open-ended, higher order thinking question. According to Greene and Yu (2015), “Middle-school student respondents [interpret] the term ‘knowledge’ broadly, including what we would call declarative, procedural, and principled types of knowledge...but that assumption might not accurately describe how participants, and particularly experts, view declarative knowledge” (p. 23) Researchers have found strong evidence supporting the use of graphic organizers and educational aids with declarative and procedural types of

knowledge. However, principled knowledge addressed through open-ended, critical thinking questions with the use of graphic organizers and educational aids still needs more investigation. For this reason, this study using MELs allows for the exploration of principled knowledge in a social studies setting.

Critical thinking is a challenge for many students, especially since public education has driven the idea of declarative and procedural knowledge as the main types of assessed knowledge with the use of Standardized tests and the CORE (Iowa Department of Education, 2009, p.1). According to Greene and Yu (2015), “Models that do not account for differences in the “simple” and “certain” nature of knowledge beliefs across types of knowledge, and instruments that include items about “knowledge” in general, are unlikely to adequately discriminate between novices and experts, leading to poor measurement validity” (p. 23) Therefore, the importance of teaching appropriate critical thinking skills relies heavily on instructional practices moving away from a “sponge and puke” method, instead focusing on the acquisition of skills in analysis, judgment, and evaluative evidence presented to form thoughts into deeper, more relevant responses. Again, the use of MELs allows for students to use principled knowledge as a basis for the skills mentioned above.

According to Lombardi et al. (2017), students using MELs to connect newly acquired knowledge with causal reasoning are successful in scoring higher on post assessments, than with traditional teaching methods. Students’ use of causal diagrams, specifically the MEL, allow students to link knowledge with supports to their thought processes--at least for the specific science topics tested. The data also suggest that

students' growth is dependent upon the effort put forth during the "knowledge acquisition stage" (Lombardi et al., 2017). Additionally, evidence suggests the importance of MELs being used correctly for maximum effectiveness. For this reason, it is essential that students be given adequate instruction in both the knowledge content and the process for using MELs.

## CHAPTER 2

### LITERATURE REVIEW

The concepts of critical thinking and graphic organizer use are not new to the educational lexicon taught in most teacher education programs; however, the term Model Evidence Link (MEL) is something that only a few have heard of or have experience using. The connectivity between critical thinking and understanding content is often blurred by a multitude of subjective thinking, instruction, and assessment which never truly reveal the level at which a student understands evidence, content, and a deeper exploration of information. In this literature review, it is noted that students at the secondary level are often expected to view content with a critical eye, but the word “critical” is never really defined and very little instruction on this occurs. For this reason, the research that supports critical thinking, graphic organizer use, and the Social Studies C3 Framework (NCSS, 2013) have always been evaluated independently, void of the possibility that if each work individually. This action research study builds on the previous evidence presented in this chapter but aims at making connections between these three areas.

#### Critical Thinking

Critical thinking and problem solving have long been terms associated with education, especially with the movement away from the traditional skill and drill practices of the past century and a half of public education in America (Passmore, 1967). However, the true teaching of critical thinking skills in the educational sense through a change in educational pedagogy and instruction has only appeared in the forefront of



educational change and reform for the past twenty-five years (Ennis, 2011). Traditional instructional practices, especially those aimed at acquiring lower-level basic facts and recall knowledge continue in our modern school, yet, teachers and administrators are seeing the need to move away from the “sponge and puke” method of instruction and prepare students for a life beyond high school that requires multitasking, collaboration, and most importantly the ability to think critically and solve problems.

The argument that critical thinking is grounded in the prior knowledge of our students is essential in growing students’ abilities to interrogate or engage in course content that builds upon the utilization of these skills by students. As Ennis (2011) argues, “Critical thinking is a critical appraisal of an array of already produced arguments, the evidence will be the data reported in the ultimate premises of these arguments. In that case, the task of gathering evidence is primarily one of analyzing the structure of the arguments in the text being appraised, so as to identify their ultimate premises.” Students who are able to analyze and apply information obtained from new content, expanding upon knowledge the student already possesses, allows students to delve beyond the surface level of learning which many courses rely on to meet learning targets and success criteria. The concept of critical thinking requires students to interact with content in such a way that students utilize interrogation and processing skills to build arguments that are rooted in acquired knowledge to demonstrate a mastery of the content or standard.

Educational or instructional aids used in classrooms must develop links between student knowledge and the acquisition of new and additional knowledge. However, there

are researchers who argue students can be exposed to critical thinking instruction without ever actually using critical thinking skills (Passmore, 1967). The belief that students who are exposed to critical thinking and then never use these skills has very little evidence; however, researchers such as Lombardi et al. (2017) lean towards the findings of Ennis (2011) and his thoughts on the connection between critical thinking and evidentiary analysis. For Lombardi et al. (2017) and for this dissertation, the development and research behind Model Evidence Links (MELs) are essential to the argument of students engaging in the use of graphic organizers that require critical thinking skills and instruction around direct content support of student developed thesis statements. According to Lombardi et al. (2017) and Ennis (2011), the use of MELs should enable students to score higher on an open-ended written response and more thoroughly support their individual demonstration of mastery.

The move from learning as being a passive idea to one in which requires students to make a more active effort to acquire knowledge requires a simultaneous change in how student knowledge is assessed. The idea of teachers placing ownership of learning on the student requires a different kind of educator and different kind of education. For many decades, education and educational assessment placed high values on tests of recall. Not only were students expected to memorize facts, important dates, and names, students were highly penalized for their lack of recall or comprehension. This practice constituted the make-up of educational practices in America for the majority of our educational past, and can still be found in school districts across the country. Even high stakes testing, until recent legislative changes, have revolved around recall and comprehension with

heavy reliance on multiple choice and true/false items. This type of assessment taxonomy is much lower than the expected learner outcomes created using the Iowa CORE as the model.

The change in assessment style and format is needed because students have access to and are being bombarded with information, both truth and myth, on a constant basis. Murawski (2014) who has written extensively about graphic organizers and assessment believes, “the paradigm has shifted in a changing world typified by instant communication, 24/7 news cycles and the desire to know as much as possible as quickly as possible” (p. 27). In my own teaching I have seen a similar movement towards the presentation of information. With the shift in the way students are presented with a constant stream of social media, streaming content, and multiple positions on the same event/circumstance, the need for critical thinking skills has never been higher. Students are forced to examine information with a critical eye or risk being misinformed, or in some cases, put at risk. The ability for teachers to impact students’ thought processes stretches far beyond the walls of the building, now more than ever. Teaching the skills associated with critical thinking and the process of making an informed decision or statement carries a much higher importance than it did just a generation ago. As with most things, education, especially the manner in which content is delivered and assessed must continue to adapt and change to meet the ever-growing demand of the students.

The ability to simply understand information is no longer enough for students to be successful in the academic classroom. Beyond simple understanding, critical thinking is needed, which includes skills like discerning the difference between truth and myth,

and forming opinions that are supported by evidence. According to Ennis (2011), “A critical thinker not only possesses critical thinking skills, but also exercises them when (and only when) it is appropriate to do so.” With a critical approach and understanding of applying new knowledge through open-ended writing prompts, teachers will engage in the process of moving the use of graphic organizers from a simple recall tool to a tool engaging students in the critical thinking process. By using the established CORE and Social Studies C3 Framework to ensure students have access to multiple levels of content taxonomy, teachers build critical evaluation and thinking skills in students of all levels.

Critical thinking is a challenge for many students, especially since public education has driven the idea of declarative and procedural knowledge as the main types of assessed knowledge with the use of Standardized tests and the CORE. According to Greene and Yu (2015), “Models that do not account for differences in the “simple” and “certain” nature of knowledge beliefs across types of knowledge, and instruments that include items about “knowledge” in general, are unlikely to adequately discriminate between novices and experts, leading to poor measurement validity” (p. 23) Therefore, the importance of teaching appropriate critical thinking skills relies heavily on instructional practices moving away from a “sponge and puke” method, instead focusing on the acquisition of skills in analysis, judgment, and evaluative evidence presented to form thoughts into deeper, more relevant responses.

The link between critical thinking and graphic organizers has been omitted in research conducted throughout the past, especially in work done with high school students. To illustrate the kinds of research most frequently conducted on graphic

organizers, and their relevant lack of connection to critical thinking constructs, consider this middle school study by Lindquist (1997), which focused on student motivation as essential to student organization and retention. Although this study did not recognize the importance of graphic organizers as a tool for evidence based interrogation or critical thinking platform, it did show how graphic organizers can serve as a tool for note organization and classroom management. Lindquist's (1997) findings are echoed by additional studies, such as Gallavan and Kottler (2007), Murawski (2014), and Dexter and Hughes (2011) that suggest a similar connection between student retention and graphic organizer use. However, nowhere in Lindquist's (1997) study or these other cited studies does the exploration of graphic organizers occur as more than a simple organization tool.

Research shows that students who are using graphic organizers that include Venn Diagrams, Flow Charts and T-Charts, are able to create an organized thought pattern when answering complex questions. For example, in another middle school study, Dexter and Hughes (2011) make a valid point in stating that students who use these organizers spend more time on the material, thus they understand the material in more depth and are better able to extrapolate information when presented with an assessment. While this does give some support to graphic organizers relating to student success, it still lacks definitive proof of success of graphic organizer use for critical thinking at the high school level. There is also lack of proof of critical thinking skills being instructed for beyond the time spent with the material. Additionally in Dexter and Hughes (2011) the complex questions were still frequently not getting at core critical thinking skills.

The aforementioned studies have focused on lower level, recall and identification to measure the success of the graphic organizer use. For this reason, this study proposed will allow for the exploration of a complex graphic organizer, MELs, and the impact they have on students' abilities to think critically, including making strong causal connections, when presented with an open-ended writing prompt.

### Graphic Organizers

Research by Gallavan and Kottler (2007) was conducted on the idea of graphic organizers as a retention aid and the effectiveness of graphic organizers as a teaching strategy. This study has especially guided the research conducted for this dissertation. The work completed by Gallavan and Kottler (2007) has many key components to the importance of graphic organizers and their ability to aid students in retention of facts, dates, and important people or even allow students to demonstrate comprehension on a reading passage. However, their study did leave an opening to investigate the inclusion of critical thinking components and specific content based evidence in guiding students to move beyond the taxonomy of recall and comprehension. They further suggest that these assessments would occur via analyses of critical thinking learning targets and responding to open-ended writing prompts.

When exploring the concept of how graphic organizers are typically used in the classroom, several problems arise including how notes are presented in class, what the student is doing to help them organize content and student understanding about what is important (Gallavan & Kottler, 2007). Oftentimes these problems occur because of a multitude of reasons, though they are usually the result of a combination of both teacher

and student factors in which both or one party struggles to use graphic organizers effectively (Reagan, 2008).

The research conducted by Reagan (2008), matches much of the findings in the study by Gallavan and Kottler (2007). Both authors break down the difficulties with using graphic organizers into three key areas. The areas include: over presentation of information, lack of communication about implied reasoning, and mixed messages about graphic organizer use.

#### Over Presentation of Information

When looking at how information is presented in class, many teachers use traditional methods of lecture (Gallavan & Kottler, 2007). The problem with this is the idea of students' inability to comprehend what is important or significant and what is not. Graphic organizers should help students determine what is significant and what is insignificant in a lecture. However, since the majority of students' experience with graphic organizers come at a younger age, where lecture is less prevalent, students may neglect to use the graphic organizers they had previously learned about.

Student exposure to graphic organizers often begins as early as Kindergarten, with simple concepts such as comparing the seasons and becomes more regularly used in upper elementary, such as when using Venn diagrams and flowcharts in a 5th grade social studies unit. Students' exposure and experience with graphic organizers tends to slow down through middle school and high school when lecture style classes become more prevalent. It is at this point that many students first begin taking notes, but oftentimes they inefficiently write down everything that is said (Reagan, 2008). Reagan

found it is important to review the ideas and concepts involved in graphic organizers with older students in order to build on their prior knowledge.

Alternatively, there are secondary students who write down very little. The idea of taking notes in a traditional notebook causes many students to miss key information. This, as a result, causes test and homework scores to suffer among average students. Due to this fact, many students miss key information presented by the teacher. Graphic organizers can help in the case of students not only taking too many notes, but not enough as well.

#### Lack of Communication about Implied Reasoning

Drawing on the idea of what is important to each individual student varies from student to student and teacher to teacher. Student misunderstanding often occurs when the teacher places emphasis on specific content that the student fails to realize as important. Students can misunderstand verbal cues and voice inflections making it difficult to understand the information being given by the teacher. The problem not only lies in the misunderstanding at the middle school level but also at the high school level (and likely for all ages!). The main cause for this problem is disorganization and the inability of students to organize information once the key ideas are classified (Gallavan & Kottler, 2007)

#### Mixed Messages about Graphic Organizer Use

The proper use of graphic organizers in the classroom is un-uniformly taught between schools or even within the same district across separate classes. Students who are not taught how to use graphic organizers or are exposed minimally to them oftentimes



are not interested in using them. They tend to shy away from using them, causing a lack of organization of material in the classroom.

Many studies have focused on a strong correlation between simple, graphic organizer use and student retention of lower taxonomy items, such as facts, dates, and names even though higher instructional and assessment taxonomy levels (e.g., synthesis, evaluation and strategic thinking) are deemed important for student understanding, mastery of content and improved critical thinking skills.

The amount of time spent completing graphic organizers must be productive in order to aid in the retention and recall of facts presented on the graphic organizer. It is imperative to use information pertinent to the topic being discussed or the standard being assessed. For example, if students in an American History class are studying a lesson on the Berlin Airlift of 1946, the graphic organizer used in the lesson should not compare conflict in Berlin between the Nazi supporters and the Jewish sympathizers during World War II, especially since, the Berlin Airlift took place in 1946, a year after the war ended. The chart would be better focused on comparing and contrasting American and Soviet support of the citizens starving in East Berlin. It is important for students and teachers to understand the proper or appropriate use for graphic organizers, for several reasons that go beyond just knowing what the right comparison should be. Even more important, the graphic organizer should be used in a way in which the information is easily retrievable for studying, understanding concepts, and mental retrieval during examinations (Doyle, 1999).

Another mixed message about graphic organizer use occurs when the teacher feels that they must tell the students exactly what to fill in. This practice occurs especially at the secondary level (Doyle, 1999). Oftentimes, with good intentions, teachers fill out the graphic organizer on the board or overhead and expect students to understand the reason for placing certain topics in certain areas. However, graphic organizers can be more effectively used if students place ideas or concepts that trigger recall in these blanks (Clarke & Martell, 1994). In this way, students are more likely to recall information, because they used key or trigger words based off of personally constructed retrieval cues.

The concept of using graphic organizers as educational aids is tri-fold (Marzano, 2010). The concepts that must be examined in the idea of using graphic organizers as educational aids are: To what effect do the concepts or ideas represented on the graphic organizer trigger mental recall when students are tested, to what extent are students exposed to graphic organizers before reaching the secondary level, and to what degree are graphic organizers used in the classroom at the secondary level. To better understand these concepts, it is important to look at each idea individually.

The concept of main points, topics, or ideas to trigger the recall of facts is used by almost all teachers on an everyday basis, whether it is mnemonic devices, acronyms, or graphic organizer, yet what many teachers fail to look at the effectiveness of the main point, topic, or idea (Key et al., 2010). When examining students' ability to recall facts, it is important to remember that students tend to remember ideas or concepts that relate to personal or prior knowledge (Gallavan & Kottler, 2007). For example, when talking

about the Great Depression, many students are able to link their feelings to those of the current recession and have a better understanding of what is being discussed. By linking keywords, topics, or main ideas to students' prior knowledge, not only are they making connections to trigger recall on a test, but the student is able to connect multiple topics, not only within the subject area but cross-curricular.

In some cases, teachers use graphic organizers on a daily basis but do not reap the full benefit from using them in the classroom. For example, students from the American History class in this study fill out cloze style notes on every lecture given by the teacher. Cloze style notes are a fill in the missing word type of graphic organizer. A Cloze style note graphic organizer is used by the student to fill in key missing words on a note sheet that is presented by the teachers. This style of notes looks similar to a fill in the blank test or quiz but is delivered using an overhead or PowerPoint presentation. By using the cloze style notes every day, the teacher is reducing the effectiveness of the graphic organizer, because of the monotony of the note taking style. Varying the type and amount of graphic organizers is much more effective for students' retention of facts.

The amount of time spent filling out graphic organizers must be productive in order to aid in the recalling of facts presented on the graphic organizer (Griffin et al., 2001). With this being stated, it is imperative to use information pertinent to the topic being discussed or the standard/benchmark that is being addressed. For example, if the American History class is studying a lesson on the Berlin Airlift of 1946, (Griffin et al., 2001) the graphic organizer, possibly a T-Chart, should not be comparing conflict in Berlin during World War II. The chart should be focused on comparing and contrasting

American and Soviet support of the citizens starving in East Berlin (Doyle, 1999). By making the information pertinent, the students are more likely to retain the information and be able to recall the important facts and concept when tested, whether that is a classroom test or a Standardized Test

For students who have learning disabilities, information presented in an organized format like a graphic organizer allows for focus on critical content instead of on the amount or time it will take to organize the information. In the study, *Graphic Organizers and Students with Learning Disabilities: A Meta-Analysis* (Dexter & Hughes, 2011), consisting of graphic organizer use with special education students to enhance memory and identify key concepts, students with learning disabilities can easily recall information and facts presented in an organized form. If graphic organizers can be effective with students with learning disabilities, they can surely be effective with students in the general education setting (Dexter & Hughes, 2011). Since most high school teachers, especially in social studies, use the traditional lecture method, most students have a hard time organizing the information presented in class into a format that they can easily use to answer complex questions and/or retain information for assessments (Gallavan & Kottler, 2007). Due to this fact, it is essential for students to understand how to use graphic organizers in and out of the classroom. Although this dissertation does not focus on students in special education, students who received IEP services are included as participants. For this specific reason, the work conducted by Dexter and Hughes (2011) is relevant.

### Graphic Organizer Problems and the Ways to Investigate Them

The problems of improper usage of graphic organizers, the misunderstanding of what is represented by graphic organizers, and what effect graphic organizers have on student retention can be explored in three main areas of inquiry (Gallavan & Kottler, 2007). These areas include: does the use of graphic organizers increase retention and recall when tested, do students use skills obtained from graphic organizers to prepare answers to questions, and what purpose do graphic organizers serve beyond the setting of high school.

Firstly, when looking at the retention of students using graphic organizers properly, it is important to understand the significance the proper instruction on using graphic organizers plays. Key et al. (2010) explains that teachers play a significant role in the understanding and ability a student has in using graphic organizers in the proper way. For example, if the teacher relates the concepts used on a T-Chart to help with comparison, to the idea of making a pros and cons list for a new bike, students can relate and have a better chance of, not only retaining how to use the chart, but the information presented with the chart. The lack of this linkage between prior knowledge and new knowledge can significantly alter the ability of the student to use the graphic organizer properly in the future, not only when examined in an academic sense, but when using it in everyday life.

Secondly, the concept of students using skills taught to them in order to prepare for tests through the use of graphic organizers is a concept that may be difficult to prove, however, the most observable key for the teacher is student comfort with the organizer

(Doyle, 1999). The comfort level of students, with the material, plays a valuable role in the understanding of student comprehension for the teacher. Along with this line of thought, it also allows the teacher the opportunity to use independent learning with the material covered, which relates to the problem students have with teacher lead information on graphic organizers (Robinson et al., 2006).

Through the use of indirect supervision of the student with the learning aid, the teacher has a better understanding of student retention before moving on in the material. These observations work in collaboration with the concept of addressing all types of learners, which is a significant need for student retention and recall on homework, testing, and standardized testing.

Third, and finally, it is important to understand the role graphic organizers play in a student's life once they have left secondary or even post-secondary educational settings (Mastropieri et al., 2003). The key significance of this portion of the concept is, does student understanding and achievement lead to the continued use of the ideas and concepts presented in graphic organizers (Mastropieri et al., 2003). When looking at this concept, it is important to understand that behind the fundamental ideas of many life skills and choices lies the ability to sort, group, retain, and recall information, all things significant to the use of graphic organizers in the educational system (Marzano, 2010). This idea is one many fail to realize when using graphic organizers in the classroom; however, students and educators must understand the impact of appropriate graphic organizer use in developing critical thinking skills.

### A Helpful New Kind of Graphic Organizer

With the amount of information available on the use of graphic organizers, especially on the use of graphic organizers as a simple recall aid, it appears that there is a missing link between graphic organizer use and students developing critical thinking skills or being able to differentiate between specific evidences that are crucial to answering these types of questions. According to the evidence presented in these studies, the use of graphic organizers is not a new or novel approach in education; however, the introduction of MELs to the realm of graphic organizers completely changes the landscape of graphic organizer use, especially in science. For this reason, the proposed action research study aims at gathering information essential in providing evidence in raising critical thinking skills of students exposed to MELs.

#### Model Evidence Link (MEL)

Bickel and Lombardi (2016), introduced a particular kind of graphic organizer called Model-Evidence Link (MEL) diagrams to teach students conceptual content that connects socioscientific, complex, and abstract issues. MELs help students to scaffold content in a way that facilitates weighing and coordinating connections between evidence and an associated model for explaining a particular phenomenon. The inclusion of MELs in secondary classrooms expands the possibilities of what graphic organizers are capable of providing high-level thinking skills (Lombardi et al., 2017). Research suggests that MELs contribute to students developing critical thinking skills. Lombardi suggests that these skills are essential to student achievement and ability to demonstrate mastery of a given skill set; as well as develops and strengthens critical thinking skills.

In terms of understanding the impact of the development of critical thinking skills, it is important to understand the difference between the ability to think with a critical viewpoint of a specific topic given specific evidences and the ability to simply understand the topic on a general level (Bickel & Lombardi, 2016). This forces students to actively engage with evidence and examine or analyze information for what specifically helps them to answer an open-ended, higher order-thinking question.

According to Greene and Yu (2015), “Middle-school student respondents [interpret] the term ‘knowledge’ broadly, including what we would call declarative, procedural, and principled types of knowledge...but that assumption might not accurately describe how participants, and particularly experts, view declarative knowledge” (p. 23) Researchers have found strong evidence supporting the use of graphic organizers and educational aids with declarative and procedural types of knowledge. However, principled knowledge addressed through open-ended, critical thinking questions with the use of graphic organizers and educational aids still needs more investigation. For this reason, this study using MELs allows for the exploration of principled knowledge in a social studies setting.

Students using MELs to connect newly acquired knowledge with causal reasoning are successful in scoring higher on post assessments, than with traditional teaching methods. Students’ use of causal diagrams, specifically the MEL, allow students to link knowledge with supports to their thought processes--at least for the specific science topics tested. According to the study conducted by Lombardi et al. (2017), data suggest that students’ growth is dependent upon the effort put forth during the “knowledge acquisition stage.” Additionally, evidence suggests the importance of MELs being used



correctly for maximum effectiveness. For this reason, it is essential that students be given adequate instruction in both the knowledge content and the process for using MELs.

Both students and teachers use MELs to gauge the level of understanding in the specified content area. In addition to being used as an assessment, the experience working through and completing the MEL allows students to develop a deeper understanding that is ultimately expressed through written responses which require in-depth explanation. The use of MELs to do both, assess and plan/organize, allows teachers to gain an understanding of their students' understanding. Bickel and Lombardi (2016) argues, "Students make sense of the evidence based not only on correct interpretations of meaning but also by describing relevant implications of the evidence" (p. 35). When students use MELs to analyze and explore links between specific evidence and a model claim, they are more likely to use critical thinking skills.

Many action research studies conducted on graphic organizers focus on lower level taxonomy skills such as recall and comprehension. At the lower level of taxonomy, students engage in a "sponge and puke" method of retention, meaning students will retain the information only long enough to regurgitate rote memorized facts on an assessment devoid of critical thinking requirements. This is especially supported by the research conducted by Bulgren et al. (2011). Their study found students who spend more time working with the content through the use of graphic organizers have more familiarity with the lower level content. However, their research fails to mention any connection between familiarity and the ability to answer open-ended, critical thinking questions. The

purpose of using MELs, when paying special attention to the research conducted by Bickel and Lombardi (2016), allows students to have the familiarity and instructional time spent with the material but goes deeper into the requirement of students to truly analyze and explore the specific evidence in the learning target. The exposure to content in this new way, especially since the Bickel and Lombardi (2016) research has been confined to science, allows students a new and interactive way of exposure to standard specific content. The ability to adapt the Bickel and Lombardi (2016) research, materials, and findings to the field of social science allows teachers and students to interact with content in such a way that is inclusive of the C3 Framework for social studies.

#### Social Studies C3 Framework

This action research study takes place in a social studies setting, which requires the exploration of the Federal Government educational program entitled the C3 Social Studies Inquiry Framework of 2013. The C3 framework focuses on the areas of College, Careers, and Civic Life preparedness in order to prepare students for the real world and post-secondary education. Within the C3 framework, standards focus on creating meaningful instruction that addresses student abilities to use social studies instruction to prepare students for real-world problem solving and critical thinking beyond the wall of the traditional school setting. According to the C3 Framework Documents (NCSS, 2013, p. 23), “Central to a rich social studies experience is the capability for developing questions that can frame and advance an inquiry.” The idea of inquiry-based learning is deeply rooted in the call for an establishment of curriculum that is aimed at improving

problem-solving and critical thinking skills. With this stated, it has allowed students to develop the much needed 21st Century skills required by the CORE.

As with graphic organizers, specifically MELs, the importance of understanding the manner in which a student is exposed to evidence is key (Lombardi et al., 2017). “Whether students are constructing opinions, explanations, or arguments, they will gather information from a variety of sources and evaluate the relevance of that information.” is a key line of text from the C3 Framework (NCSS, 2013) in regards to the importance placed by the Federal Government on the ability for students to problem solve and think critically. Students are inundated with data, information, and evidence on a daily basis, especially when considering the average student takes six required courses during a semester. With this amount of evidence constantly bombarding their brains, it is important for students to understand which evidences are essential in making connections to their learning.

The connection between the intended learning outcomes of the C3 framework (NCSS, 2013) and the research conducted by both Bickel and Lombardi (2016) and Murawski (2014) have connections to the importance of students developing and interacting with specific evidence to provide support for critical thinking elements of instruction. As with the C3 Framework (NCSS, 2013), the ability to develop assessment models that move away from the reliance of simple recall, towards a more deeply developed written response, the research conducted by Murawski (2014) provides support for students’ interaction with evidences that do not support one correct answer, but rather a range of answers with depth of knowledge. This connectivity to critical

thinking is shared through the development and use of MELs. MELs require students to actively engage with content, as opposed to passively “absorb” content (Bickel & Lombardi, 2016). Through this active engagement with the content, students develop different levels of understanding on specific C3 Framework (NCSS, 2013) learning objectives.

## CHAPTER 3

### METHOD

Two main research questions emerged from a review of the literature on the areas of critical thinking, graphic organizers, and open-ended writing responses. The two questions are:

1. How does teaching MELs, aimed at creating content and causal relationships, affect student performance on assessments containing open ended, critical thinking questions?
2. What impact does the use of MELs have on students' critical thinking abilities?

This chapter describes how these questions will be answered along with a short description of anticipated results.

#### Participants

The participants in this action research study attended a small, rural, predominantly white school, which houses grades PK-12 all in one building. Many of the students attended this small-town school from the beginning; however, 112 students chose to attend this small school through the open-enrollment process. With 451 total students, this makes up nearly 25% of the student body during the 2018-19 school year. In the four high school courses who participated in this study, there were a total of 22 World History students ranging in age from 14-16 and in Economics there were 33 students ranging in age from 17-18.

The World History classes were made up of 10 open enrolled students and 12 students living within the district boundary. These two courses also contain two students

served on IEP, which required them to have a one-on-one paraeducator in the classroom. The Economics classes were made up of 9 open enrolled students and 24 students living within the district boundary. The Economics class has zero students served on an IEP. Due to the amount of open enrolled students, most of which have only attended Baxter during high school, with the addition of having to develop new content connections for student learning, the building of a similar (common) background knowledge was the objective of these courses. This was essential to ensuring students received the appropriate CORE instruction required.

In terms of previous experience with graphic organizers, the participants had been exposed on a limited basis, which included small amounts of exposure to lower-level graphic organizer; such as flow charts, and mind webs. This exposure was limited because there was a lack of consistent effort from teachers to include graphic organizers as a part of their instruction. Another key reason the students had limited exposure was the push towards a multi-tiered approach within the instructional framework of the district. In the last six years, there was a movement away from traditional instructional methods, while teacher preparation and development centered on students inquiry-based learning. With this shift, the use of MELs with these four different classes was not impeded by any previous experience or exposure to graphic organizers of this type. Appendix A defines these terms in working definitions for this study.

### Materials

Students in this action research study participated in the use of MELs covering two different units. The Economics classes participated in the instruction and assessment

for a four week time frame and the World History classes for five and a half week time frame. The materials used in this action research were researcher created, with influence and instruction from the creators of the MEL (see Appendix B). The MEL for each unit was created to model the Bickel and Lombardi (2016) MELs explained in Chapter 2. Appendix B showcases the four MELs that were used with the World History and Economics classes. The students were presented with two learning targets (Models A and B) and four pieces of evidence. At the conclusion of the content instruction featuring the learning targets and pieces of evidence, the students completed the MEL. As can be seen in Appendix B, differing styles of lines were used to make connections between the evidence and learning target portions of the MELs. These were then used by students in preparation for the open-ended writing assessment that was completed at the end of the six-week time frame.

Aside from the newly created MELs for this dissertation, the researcher modified a scoring rubric (located in Appendix B) based upon an already existing rubric found in Marzano (2010). The rubric examines and evaluates the students' writing sample on both writing and content knowledge. Also, this scoring rubric was used by both raters in the assessment of the students' open-ended responses on the pre-and post-assessments.

The open-ended writing prompts that were directly related to the instructional content and both, the learning targets and evidences presented on the MELs to measure students' growth. These writing prompts are directly related and created using Iowa CORE learning standards. These are the prompts that students used to create the open-ended writing samples that were evaluated using the scoring rubric.

In addition to the new MELs, scoring rubric and writing prompts, this dissertation used research-based instructional materials to implement a variety of instructional strategies that students had been exposed to throughout the school year. These strategies included: “think, pair, share”, “I do, we do, you do” modeling, and direct instruction. Modeling is a widely used instructional strategy that encompasses the teacher or student in the class demonstrating a new or revised method, skill, or approach to learning content. Oftentimes, modeling uses the “I do, we do, you do” approach in which the teacher or students model the method, skill, or approach. The class then engages in guided practice, followed by the students attempting the method, skill, or approach individually. This approach allows for student questions and gives the teacher a chance to engage in formative feedback that is both timely and appropriate for the method, skill, or approach.

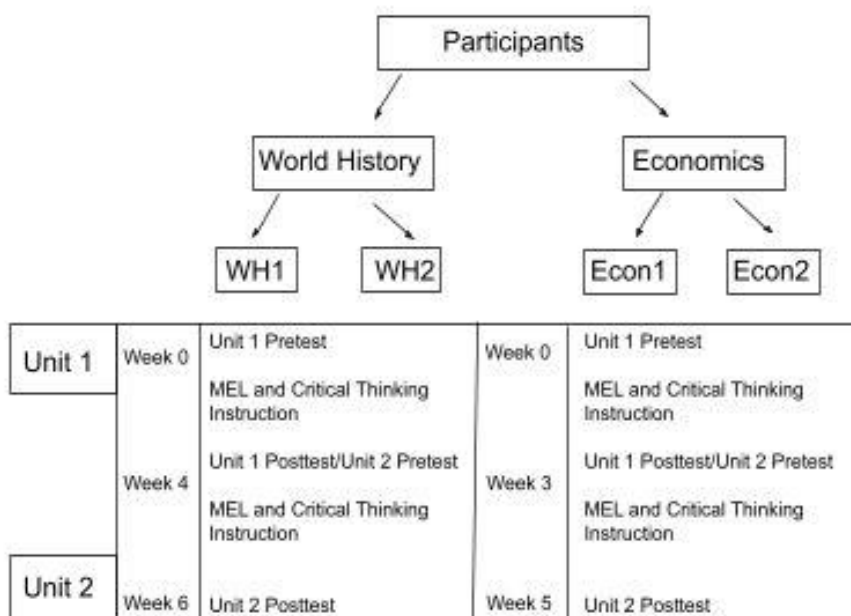
As with modeling, “think, pair, share” allows students to work in the opposite order of “I do, we do, you do”. In this approach, students work independently first, thinking about ways to solve a problem, answer a prompt, or share understanding with the class. The teacher will then partner or place students in a small group and have them share their thinking. Best practices have each pair or small group choose a member to share with the whole class. Again, this gives students the opportunity to receive feedback or deepen their thinking about the topic through the practice of collaboration.

This was used to ensure that the change in assessment data is related to the MELs and not the instruction. The students continued to use their assigned Chromebook for instructional activities and completion of the writing portion of the research.



## Procedure

In this study, two sections of two social studies courses at a high school from a rural Iowa school district were divided into two groups for testing the efficacy of MELs on learning in social studies knowledge domains. Each course, World History and Economics, had two sections that participated in this action research. The grouping was predetermined by the scheduling of students through the school counselor's office. The schedule allowed for mixed levels of academic abilities among the students. The total time of instruction was expected to last six weeks, but the instruction for the World History units lasted five and a half weeks, while the Economic units lasted four weeks due to graduation. Each of the classes covered two different units of content in each course.



Students in both sections across the two Economics and two World History courses were instructed using the same subject matter with a similar pedagogy. In addition, the inclusion of specific instructional components in completing and accessing information from the MELs were broken down to the specific components and taught individually to allow students multiple opportunities to interact with each part of the MEL. MEL instruction was conducted this way in both groups during the entirety of the weeks of instruction for both groups.

During the period of time the study was conducted for each group, students were exposed to two different content units. In World History, the students explored content in the units entitled: *Unrest in the Middle East* and *The Ever-Changing World* (See Appendix B). In Economics, the students explored content in the units entitled: *Government Involvement* and *Personal Finance* (also in Appendix B). Within the units, students engaged in content that was specific to the learning target and standard. Students were exposed to specific models within each unit and given multiple modalities to interact with the evidence. This included teacher led (direct instruction), inquiry based (students led instruction), and cooperative learning opportunities. However, the three twenty-minute instructional days using MELs each week were delivered through direct instruction and teacher modeling. In addition, students participated in traditional classroom setting and management styles.

Both Economics sections and both World History sections were given a similar pretest and post-test, composed of the same open-ended question in each content area for

each of the two instructional units. Following the completion of the pretest and an analysis of that data, new instructional decisions were made.

After the pretest, the students were exposed to a multitude of instructional strategies, including “think, pair, share”, “I do, you do, we do” modeling, direction instruction, jigsaw reading, and analysis of contextual passages individually and in small groups. Content specific contextual passages allowed students to gain skills in determining what evidence supported the author’s claims, similarly to what the MEL requires students to analyze with specific claims and evidence. Students engaged in “I do, you do, we do” modeling of reading for finding evidence and then analyzing a passage to find specific contextual support for the claim. This connected with the learning target posted for each unit, which directly supported the learning standard.

The analysis of content was also explored through the “think, pair, share strategy”. The focus on analysis allowed the teacher to ensure students had a strong foundational understanding of the connection between the claims and supports of the contextual evidence.

Throughout the course of instruction, each group received three 20-minute instructional lessons per week. In total, sixteen twenty-minute instructional lessons on the use of MELs for the World History classes and twelve lessons for the Economics class occurred during the study. This instruction was provided to all groups on the same day and at roughly the same time during the class period to keep instruction as equivalent as possible. The instruction centered on exploring what evidence was, how it connected to the learning target, and justification for why students felt a specific model connected to

the evidence from their perception. Students were asked to justify their connections to evidence to allow for the teacher to make differentiated instructional choices as the unit progressed. In addition, the justification process required students to directly reflect on why connections were made between evidence and the models, which was intended to build a deeper understanding of the content presented through the classroom and MEL instruction.

### Measures

Students were given a pretest and posttest before and after content instruction in each unit. The pretest and posttest were each scored on a common rubric that required students to make connections between the information presented in class and the information noted on the MEL (See Appendix C). Responses were measured by the researcher and a second rater for the ability of students to develop connections and critical thinking skills. For accountability, a measure of interrater reliability was calculated to ensure the results remained as objective as possible. The second rater was another social studies teacher who assessed the written portion in the same manner as the researcher. To calibrate the rubric scoring method, the instructor and the researcher worked collaboratively on scoring a random selection of five responses. Following the scoring of each response, the second rater and the researcher discussed the reason for each section of the rubric. This discussion allowed for them to resolve differences to ensure a minimal amount of rating differences between the student scores on the pre- and posttests. After initial differences were resolved, the second rater then scored 25% of the writing samples in each class, drawn at random from the physical copies of the work. To

determine interrater reliability, Cohen's Kappa was used to assess agreement between the researcher and second rater. Agreement was very high for both the pretest (.94) and perfect (1.00) for the posttest.

Responses were measured for the ability of students to develop connections between specific content learning targets and standards; as well as, critical thinking skills pertaining to composing a written response. Again, these responses were rated through the use of the scoring rubric in Appendix C and with a second rater. Furthermore, students focused not only on content but the creation of strong contextual support for the thesis statements. These contextual supports were developed and used to demonstrate an understanding of both contextual connections and essential information acquired through MEL inclusion in the instructional practices. Successful utilization of the MEL was defined as a growth in students' rubric scores from the pretest to the posttest.

Research Question One, "How does teaching MELs, aimed at creating content and causal relationships, affect student performance on assessments containing open ended, critical thinking questions?" was evaluated through repeated measures analyses of variance (ANOVAs) with student rubric scores as the dependent variable. The areas of the rubric that was analyzed to measure for growth in the areas of content and causal relationships were #3 *Evaluating Evidence* and #5 *Relationship between the supports and the evidence*. These portions of the rubric isolated the students' growth during the unit. This was influenced by interactions with the evidence arguments and the understanding of causal relationships within the content, while being instructed on new content and

working with the MEL to create strengthening arguments in support of the learning target.

Research Question Two, “What impact does the use of MELs have on students’ critical thinking abilities?” was evaluated through a comparison of the evidence-based support statements addressing the specificity of the thesis statement. This was measured by the second and third assessment portions of the written response rubric, which gathered assessment data on the ability of students to use supports for context and demonstrate the ability to acknowledge other perspectives. For example, when answering the written prompt on Climate Change, portion two and three of the rubric would have examined the student’s understanding of religious, political, or social beliefs of those living in developing countries on the perspective of that country’s population on pollution or natural resource contamination. The reasoning for this is when evaluating a student’s growth in critical thinking skills, the depth of knowledge showcased in this portion of the written response demonstrates the growth in specific content knowledge and evidence supported by the work of the MELs. Students who grew in this area demonstrated stronger connections, as measured by the rubric, between evidence presented on the MEL, content presented during instructional time, and the strength of the written supports for the thesis statement of the written sample. There was a crossover in evaluating the data between the two research questions because of the way in which critical thinking is addressed in both research questions. Additional descriptive and inferential analyses based on student demographics was conducted as a means of further exploring each of the two research questions.

### Anticipated Results

It was anticipated that students who truly applied themselves in both the content learning and the procedural learning for completing the MELs would grow in their critical thinking about the specific content as it related to the assessed learning target and standard. This would be demonstrated through an increase in their rubric score, especially in the rubric areas of Understanding Perspectives and Evaluating Evidence which were examined in isolation to ensure that the growth from pre to post-assessment was a result of the MEL usage and not simply the new content knowledge acquired in the instructional unit.

It was also anticipated that students would be more likely to question evidence and explore topics in more depth with a critical perspective following the critical thinking and specific MEL instruction. Students who engaged in the direct instruction on MEL use and the varying instructional models should be able to not only construct a strong thesis statement, but also use contextual evidence to build a well thought out, coherent, and supported response to the open-ended writing prompts.

## CHAPTER 4

### RESULTS

The purpose of this study was to examine whether a research-based method such as MELs could deliver consistent results in growing students' understanding of content, while allowing them to interrogate content and demonstrate knowledge of critical thinking skills through a written response. When examining the results of this quantitative study, it is important to be reminded about the students who participated in the study and the research questions the study attempts to answer. First, the students who participated in this study attended a rural school district that was equidistant from three major urban areas in central Iowa. Gender was not measured in an attempt to further distance the researcher from knowing how students scored, since the researcher was also the instructor for each of the four classes.

Also, as a reminder, the two research questions that guided this study were:

1. How does teaching MELs, aimed at creating content and causal relationships, affect student performance on assessments containing open ended, critical thinking questions?
2. What impact does the use of MELs have on students' critical thinking abilities?

#### Descriptive Statistics

##### InterRater Reliability

To ensure validity and reliability in this study a second rater was used to calibrate the scoring of the rubrics on both the pre and post assessments. The second rater scored 25% of the same pre and post assessment written responses for both units with any



remaining differences resolved in conference. The data showed a strong agreement between the score given to this subset by the interrater and the entire sample scored by the researcher. Cohen's Kappa was used to measure the amount of agreement between the interrater and researcher. As a reminder, Kappa scores ranged from .797 to 1 suggesting a good agreement.

#### Improvement from Pretest to Posttest.

As indicated by Table 1.1, students in each of the four classes made between 2.20 and 5.61 points of growth from pretest to posttest on average. Student scores averaged a larger gain in the two World History classes, almost double the average growth per student in the Economics classes when scored on the entire scoring rubric. The open-ended responses required students to make connections of varying strengths between the content and the model in order to showcase student knowledge on the topic.

**Table 1.1** Change in total rubric score from pre to post assessment in all four classes for both instructional units

<b>Course and Instructional Unit</b>	<b><i>N</i></b>	<b>Pretest <i>M</i> (<i>SD</i>)</b>	<b>Posttest <i>M</i> (<i>SD</i>)</b>	<b>Gain</b>
<b>Econ 1</b>	<b>31</b>	<b>9.10 (5.10)</b>	<b>12.00 (5.79)</b>	<b>2.9</b>
<b>Econ 2</b>	<b>10</b>	<b>9.50 (5.42)</b>	<b>11.70 (6.22)</b>	<b>2.2</b>
<b>WH 1</b>	<b>21</b>	<b>8.24 (4.57)</b>	<b>12.48 (4.89)</b>	<b>4.08</b>
<b>WH 2</b>	<b>18</b>	<b>11.28 (5.12)</b>	<b>16.89 (4.81)</b>	<b>5.61</b>
<b>Total</b>	<b>80</b>	<b>9.41 (5.04)</b>	<b>13.19 (5.79)</b>	<b>3.78</b>

The highest gaining groups on the entire scoring rubric were the two World History courses. World History 1 made a gain of 4.08 points on average and World History 2 made a gain of 5.61 points on average, which is nearly a point and a half more growth than any of the other three courses. The difference in gain between the two Economics classes had .70 points, on average, and the difference in gain between the World History classes was 1.53 points. As the data in Table 1.1 illustrates, students as a whole gained 3.78 points, on average from pretest to posttest.

To ensure that the instructional time spent specifically on MELs and MEL usage was the cause for the average increase among the classes of students, rubric Item 3 and Item 5 were isolated for examination of student growth. Rubric Item 3 especially examined students' individual understanding of the role perspective plays in learning content through student engagement with both models and evidence. Rubric Item 5 isolates the student's individual ability to evaluate and support main ideas from models with evidence. These two rubric items are especially important towards answering components of both Research Questions.

As indicated by Table 1.2, the increase from pre to post assessment scores for Rubric Item 3 was .35 and .70 points. As a reminder, Item 3 measured how MEL instruction helps students create content and causal relationships. While the World History classes made gains of .62 and .66 respectively, the largest gaining class was the Economics 2 class which made a gain of .70 points. Over the entirety of the four classes, students gained more than half of a point, on average (.53) from pretest to posttest on this single scoring rubric item.

**Table 1.2** Change in Rubric Item 3 score from pre to post assessment in all four classes for both instructional units

<b>Course and Instructional Unit</b>	<b><i>N</i></b>	<b>Pretest <i>M</i> (SD)</b>	<b>Posttest <i>M</i> (SD)</b>	<b>Gain</b>
Econ 1	31	1.71 (.86)	2.06 (1.03)	.35
Econ 2	10	1.30 (.82)	2.00 (.94)	.70
WH 1	21	1.52 (.60)	2.14 (.79)	.62
WH 2	18	2.28 (.75)	2.94 (.72)	.66
<b>Total</b>	<b>80</b>	<b>1.74 (.82)</b>	<b>2.27 (.95)</b>	<b>.53</b>

**Table 1.3** Change in Rubric Item 5 score from pre to post assessment in all four classes for both instructional units

<b>Course and Instructional Unit</b>	<b><i>N</i></b>	<b>Pretest <i>M</i> (SD)</b>	<b>Posttest <i>M</i> (SD)</b>	<b>Gain</b>
Econ 1	31	1.55 (.81)	1.90 (1.01)	.35
Econ 2	10	1.60 (1.075)	2.20 (1.23)	.60
WH 1	21	1.62 (.81)	2.38 (1.02)	.76
WH 2	18	2.00 (.91)	2.78 (.88)	.78
<b>Total</b>	<b>80</b>	<b>1.68 (.87)</b>	<b>2.26 (1.05)</b>	<b>.48</b>

As indicated by Table 1.3, students gained between .35 and .78 points from pre to post assessment scores for Rubric Item 5, which measured the impact of MELs on students' critical thinking abilities. While the World History classes made gains of .76 and .78, respectively, unlike Rubric Item 3, both Economics courses had smaller gains of .35 and .60. The individual class gain scores, on average, were comparable to the gain scores from Rubric Item 3. In fact, the Economics 1 course had the exact same gain score, on average, of .35 points on both Rubric Item 3 and Rubric Item 5. Over the

entirety of the four classes, students gained nearly half of a point (.48) from pretest to posttest on this single scoring rubric item. These results suggest that the use of MELs increased students' ability to use specific contextual evidence from the unit to critically examine and respond to the open-ended writing prompt.

### Question One Analysis

Research question 1 asked, "How does teaching MELs, aimed at creating content and causal relationships, affect student performance on assessments containing open ended, critical thinking questions?" According to Table 1.4, the direct MEL instruction led to significant growth in the ability of students to use the evidence to support not only the Models, but also the thesis statement of the required written response. The between subject variable was used as a check to ensure there was no effect of class size and was non-significant.

**Table 1.4** Within subject ANOVA using the test was taken (pretest or posttest) as the predictor (independent variable)

<b>Predictor</b>	<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>p</b>	<b>partial <math>\eta^2</math></b>
Pre/Post	474.82	1	474.82	52.67	< .001	.41
Class	56.78	3	8.93	2.01	.11	.18
Error	685.2	76	9.02			

A Two-Way 2x4 mixed ANOVA was used to compare the means of the growth between pre and posttest scores and which class the students were enrolled in (World History 1, World History 2, Economics 1, and Economics 2) on the entire scoring rubric.

This ANOVA focused on two factors for the independent variable (Pre/Post Test Score and class enrollment). Ultimately, there was no significant interaction across the factors and use of MELs.

As indicated in Table 1.4 there was a significant effect on student scores from the pretest to the posttest ( $p < .001$ ) and the effect between classes was non-significant. A calculation of the effect size (*partial*  $\eta^2 = .41$ ), suggests that this finding was a large effect, and shows the positive impact of use of MELs across two content areas.

#### Question Two Analysis

Research question 2 asked, “What impact does the use of MELs have on students’ critical thinking abilities?” To best analyze this question, Rubric Items 3 and 5 were analyzed individually. Rubric Item 3 directly measured students’ abilities to examine the impact of perception of evidence as it supports the model (learning target), and Rubric Item 5 isolated the student’s individual ability to evaluate and use evidential supports when interrogating models (learning targets) for necessary understanding impact on the evidence and the impact individual’s understanding of specified content. In both of these items, students were required to use critical learning to combine their individual understanding of specific content and the direct critical link between evidence and a model. The data presented in Tables 1.5 and 1.6 indicates how students’ scored on Rubric Items 3 and 5, respectively, based on when they took the test (pre/post) and which class they were enrolled in.

For both Item 3 and 5, a Two-Way 2x4 mixed ANOVA was used to compare the means of the growth between pre and posttest item scores and which class the students

were enrolled in (World History 1, World History 2, Economics 1, and Economics 2). In both cases, there was no significant interaction across the factors with students' Item 3 or 5 scores. There was also no significant difference in Item 3 or 5 scores across the four classes (for Item 3,  $F = 1.29, p = .28$ ; for Item 5,  $F = 1.83, p = .26$ ), meaning that the effect of MEL instruction did not change Item scores due to student class placement. However, as indicated in Table 1.5 and 1.6 there was significance in students' Item 3 and Item 5 scores from pre to posttest based on the intervention of direct instruction for the use of MELs (for Item 3,  $F = 51.79, p < .001$ ; for Item 5,  $F = 36.91, p < .001$ ). The effect size of Item 3 and 5 scores from the pre to posttest was very large at .41 and .33 respectively.

**Table 1.5** Within subject ANOVA using pre and posttest Rubric Item 3 as the predictor (independent variable)

<b>Predictor</b>	<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>p</b>	<b>partial <math>\eta^2</math></b>
Item 3 Pre/Post	11.63	1	11.63	51.79	.00	.41
Class	.869	3	.290	1.29	.28	.05
Error	17.08	76	.225			

**Table 1.6** Within subject ANOVA using pre and posttest Rubric Item 5 as the predictor (independent variable)

<b>Predictor</b>	<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>p</b>	<b>partial <math>\eta^2</math></b>
Item 5 Pre/Post	13.21	1	13.21	36.91	.00	.33
Class	1.46	3	.50	1.83	.26	.05
Error	27.21	76	.36			

## CHAPTER 5

### DISCUSSION

#### Reviewing the Context of this Study

The purpose of this study was to examine whether a research-based method such as MELs could deliver consistent results in growing students' understanding of content, while allowing them to interrogate content and demonstrate knowledge of critical thinking skills through a written response.

#### What Impact does the use of MELs have on Students' Critical Thinking Abilities?

The study was designed to research the impact of a specific graphic organizer, called Model Evidence Links, referred to as MELs, on the written responses, specifically targeting the ability of secondary students to use specific supporting evidence in determining or proving a connection between a specific content writing prompt while thinking critically about the development of their own contextual understanding. The written prompts, used in the study, were developed to directly measure students' ability to use a multitude of contextual evidence and instruction practices to investigate the connection between this evidence and the required learning target.

The ability to think critically is often viewed by those in education as the ability of students to observe a situation or problem and apply previous learned skills or content with newly acquired skills and content to come to some kind of logical conclusion. For the purpose of this study, the critical thinking component existed in multiple areas of the unit including assessment, curriculum, and both student and teacher led instruction. With the inclusion of instructing new content, but requiring students to apply this knowledge to

a new and previously unseen organizer, the study required students to actively engage in critical thinking skills. This meant students were required to not only demonstrate the acquisition of new knowledge, but to express their understanding through an evidentiary supported written response. In the process of finding evidence that directly supports the student thesis or topic sentence, students were engaged in an interrogation of evidence as it pertained directly to the model (learning target). However, students had very little direct instruction or experience with graphic organizers in the past that required inquiry based instruction. As was noted previously in the study, students often used graphic organizers during instruction to simply organize thoughts or retain simple recall information, but had limited exposure to graphic organizers that required students to process above a retrieval level of rigor.

Since the majority of the students had the same social studies teacher in the secondary setting, the concept of critical thinking instruction in social studies was not new. Therefore, the combination of continued instruction in critical thinking with the addition of the MEL allowed students to explore content with a more rigorous level of instruction.

In previous portions of the school year, students were given similar writing tasks in the four classes that participated in this study. Although the same style of writing prompt was used, students only received the content instruction rather than instruction about how to write a prompt. In many cases, it was observed that students improved from the pre-assessment writing prompts to the post-assessment writing prompts. This was measured by using a simple rubric that evaluated both grammar and content



knowledge. The results of this dissertation provide strong evidence that students' improvement from pretest to posttest was the presence of MEL instruction, since other factors were either controlled for (e.g., instructor, and amount of instruction) or, the case of course types, were shown to be non-significant.

Other potential factors that may have contributed to students' performance on their writing prompts are still worth noting here. For example, students missed school for a multitude of reasons, especially during the final eight weeks of school, while MEL instruction was taking place. This included, but was not limited to field trips, sporting events, graduation practice, and school assemblies. Although students did miss class, it was important that these students received the missed content and instruction. Since the study focused on different grade levels of students in the same courses, student writing styles differed, especially among older students. The loss of class time may have caused issues for some students, although the students ultimately received the same instruction in a different time and in the same format. Therefore, it is likely that these absences were adequately controlled for.

How does teaching MELs, aimed at creating content and causal relationships, affect student performance on assessments containing open ended, critical thinking questions?

In order to analyze the impact that MELs and MEL instruction had on students' ability to think critically about a specific model a baseline needed to be established. Students in each course, two sections of each, were given the same open-ended writing prompt. Students were measured on contextual supports and prior content knowledge. A

key tool in assessment of the students' written work was the chosen rubric (see Appendix C) which measured both critical thinking elements, like evaluation and analysis of information, and interactions between evidence and models. The use of this rubric allowed for analysis by the researcher and an interrater which ensured reliability and validity in the findings.

It was not surprising that across all four classes, the pre-assessment scores for both units, students averaged 9.4 out of 24 points on the rubric because the content was new and the rubric used to score the assessments was more specific than the traditional rubric used in these courses. However, what was surprising was the fact that one class, World History 2, which was the second unit measured for this course, was nearly 2 points higher than the average score with a pre-assessment score of 11.28. There are many possibilities for this reason, including a smaller sample size, writing abilities of the students, and students' varying levels of prior knowledge acquired outside of the classroom setting. This, however, did not change the implementation with any group during the second unit of study. Students still followed the procedure outlined in the methods section of the study.

When examining the pre-assessment, it was apparent that students struggled with both the content and the execution in supporting their written sample with contextual evidence. According to Table 1.2, when specifically examining Rubric Item 3 which measured students' ability to use evidence to support the model (learning target), all classes scored below 2.5 out of 4 on the specific rubric item. These data shared similar findings with the research conducted by Bickel and Lombardi (2016) in terms of students

scoring minimally on the pre-assessment; however, a notable difference was that Lombardi focused solely on science content. As with his study, students in this study struggled to connect content to a writing task in which they have limited understanding and prior knowledge.

To analyze the impact of the MELs on building skills for critical thinking among students, it is imperative to understand the factors that have impacted the students' retention of these skills, not only in an academic setting, but also after formalized education is completed. Students in this study were instructed using traditional instruction models, mainly via direct instruction by the teacher using a lecture model supported by skill acquisition through textbook reading and retrieval level assessments. Traditionally, these students were given writing prompts in ELA courses or as part of a "project" in science and social studies courses. However, the World History students for the previous three years had participated in instruction similar to the study, without the specific focus on the connection between critical thinking and specific supporting evidence. Therefore, the data from Table 1.1 showed higher pre-assessment scores from both World History courses than the Economics sections. This result is not surprising considering the Economics students had not had the opportunity to engage in this type of thinking since middle school, three years prior.

#### Impact of Instruction

While it is noted that both samples of students had some prior instruction about critical thinking skills, it was different from the MEL instruction that was used with this study. The concept of using the MEL to instruct critical investigation of models and

evidence allowed for both teacher and students to dive deeper into specific content with a critical eye on using evidence to support a written response to a specific question.

Students were first exposed to MELs at the beginning of the first unit, following the pre-assessment writing prompt, by asking students to examine the unit learning target with four pieces of evidence written on the board. Students were asked to connect each evidence to the learning target with three types of lines; strongly supported, somewhat supported, or did not support at all. Students were then asked to write a short explanation for why they chose the lines they did. After this, students partnered with someone who they typically did not choose to group with in class and discuss their explanations for each line. As the teacher moved around the room it became apparent that students had varying levels of understanding as it related to both the content and the reasoning for the connection between the evidence and the model. These observations were used to make instructional decisions and adjustments to content instruction (i.e., differentiation). However, this did not change the way in which students received instruction on using MELs. MEL instruction was delivered through a traditional, teacher led approach. However, this does not mean that students did not have individual time to explore and process the analysis component of the interactions between the evidence and model.

In addition to the MEL instruction, students experienced multiple instructional modalities, including differentiated instruction specific to content. Students used MELs (Appendix B) to explore connections between the evidence presented in class through the instructional methods mentioned above and the learning target. This allowed students to discuss, investigate, and acquire content knowledge that created connections between

critical thinking skills and strategies and the process of using these skills in coordination with newly acquired content to support written responses, specifically citing key evidence from the MELs in support of the students' thesis statements in written response. Students did not receive any direct instruction on the construction of a well written response to an open-ended question. For this reason, it can be concluded that the growth from pre-assessment to post assessment is attributed to the students' interactions and investigation of content as it pertained to MEL usage and classroom instruction supporting the understanding of material used in student support of the learning target. These findings support the research completed by Greene and Yu (2015) concluding that graphic organizer use builds connections between contextual evidence in students' thinking to form critical understanding and the ability to analyze evidence in support of the critical thinking process.

While the findings from the Greene and Yu (2015) study indicate graphic organizer use as a sufficient way to build connections between contextual evidence, it fails to explore the strength of using graphic organizers to develop deeper exploration or interrogation of content. This study expanded upon the understanding of the findings discovered by Greene and Yu (2015) through the exploration of including depth of knowledge with graphic organizer use in critical thinking instruction. The understanding of graphic organizers as a visual representation of content was expanded to include student experience in creating connections between evidence and models. The inclusion of the findings of the work by Greene and Yu, in addition to the component of depth of

knowledge and the connection between critical thinking and student growth allowed this study to expand upon the work conducted by Greene and Yu (2015).

#### Connections between Critical Thinking and Student Growth

In exploring the connections between critical thinking and student growth in this study, it is essential to examine the shift from passive learning to active learning as explored by Murawski (2014). His argument of growth through exploration and interrogation was observed during this study. For example, as was previously discussed, students were taught using traditional teaching methods including, both teacher and student led learning, small group instruction, and the student inquiry model when exploring the content. This allowed for the students to truly engage with the class content. Additionally, because it is difficult to directly measure what students were thinking as they processed through the MEL instruction, students were asked to generate justifications for their choice in “arrow” usage, which was a means for making active learning more overt. By having students justify their reasoning, it was possible to isolate areas of lacking skill within the MEL use itself, which allowed the teacher to more actively and strategically ensure students had the same level of understanding for MEL use.

When examining the effect causal relationships have on the ability of students to connect specific contextual evidence and learning targets, it was essential to ensure that students had access to evidence that was both supportive and contradictory. Using the Social Studies C3 framework, the students engaged in inquiry based learning strategies. These included the use of primary sources and analysis level tasks to develop contextual

understanding at a multifaceted level. Students were asked to examine content through a multi-perspective approach in regards to the open-ended questions that required the students to actively engage with the content and the MEL. Students were asked to connect contextual evidence, which they were presented with from the teacher, and the learning target (model). Students were then tasked with investigating each piece of evidence through the critical thinking lens of gathering information from a variety of sources, which had both been presented in class and required student exploration outside of class, to evaluate the relevance of that information. This process, along with the justifications written by the students, allowed the teacher to examine the students' understanding of both the content and the connection between the evidence and the learning target (model).

As with the C3 Framework (NCSS, 2013), the ability to develop assessment models that move away from the reliance of simple recall towards a more deeply developed written response, the research conducted by Murawski (2014) confirms what was done in this study for encouraging student interactions with evidences that do not support one correct answer, but rather a range of answers with depth of knowledge.

The findings of this study, while mirroring findings in the Murawski (2014) study suggest student interaction and interrogation of evidence lead to a deeper understanding of the material; however, this study found that the C3 Framework and critical thinking deepened the understanding for the majority of students when responding to an open-ended response. Student interrogation through MEL processing allowed students to make content specific connections with the model (learning target). Murawski supported the

use of a wide variety of answers, recalled and explained to a specific question. The use of specific content evidence by students in the open-ended writing prompts differed from Murawski by supporting a range of answers through an open-ended written response with depth of knowledge.

This concept was very important in the instructional and assessment process of this study. The concept of multiple approaches to respond to an open-ended writing prompt allows for students to demonstrate a plethora of connection and causal relationships between the evidence and the model. In addition, it allowed students to develop a critical understanding and perform a critical analysis of the content as it pertained to the writing prompt. This process also allowed the teacher the ability to assess and ensure students were making connections and understanding the material at a taxonomy higher level than retrieval.

As thorough as this study attempted to ensure the measurement of growth based on the use of MELs to explore and interrogate contextual evidence, it was nearly impossible to ensure that all students completed the work with fidelity. Students not completing their work with fidelity could have been caused by several factors including, but not limited to: missed class time for field trips and extracurriculars, the study being conducted at the end of the school year, and “senioritis”. For these reasons, when looking at the data, it is not surprising that the Economics units, in which the class was majority seniors, scored lower than the World History units which consisted of mainly freshman and sophomores.



### Effectiveness of MELs and Critical Thinking Instruction on Student Learning

When exploring the data collected from pre- to posttest it was clear that students made growth in each class on each unit. Evidence from this study suggests that these improvements were due to specific MEL instruction. Bickel and Lombardi (2016) had similar findings in their study; however, their study was focused on content specific to science instruction with clearly defined scientific law and reasoning principles that guided the student interaction with the evidence and model. In this study, the social studies content and instruction was only defined by the bounds of student understanding and the amount of time students had to interact with the evidence and model. What follows is a discussion for why this conclusion is warranted by exploring potential alternative reasoning for why students may have improved looking more closely at some of the factors that may have contributed to the results.

#### Open-Ended Question Experience.

Open-ended questions are a very important part of any social studies curriculum and allows for the assessment of deeper understanding of contextual understanding by students. Therefore, students in this study received instruction in multiple courses throughout their secondary school experience that focused on constructing a five to seven sentence paragraph using technical writing skills. However, many students struggle with supporting their answer or written response with factual, supporting evidence from instruction or supplemental materials. In this study, written responses were scored based on a rubric that assessed this specific skill. Rubric Items 3 and 5 assessed the ability of students to frame perspectives with evidentiary support within a written response to a

prompt question, and the results from this study showed a significant improvement from pretest to posttest, suggesting that MEL instruction, rather than past technical writing skills were the reason for improvement.

#### Item 3 and Item 5 Gains.

When exploring the possibilities for the reasoning that this group would be almost an entire point higher on one rubric item and more than .55 points higher on the other is interesting. In the World History group, the sample size was smaller during the first unit and then larger during the second unit than the Economic group. However, ten students did complete the second unit work in Economics but scored only a small percentage lower than the larger sample during the first unit. The drastic change in sample size from unit 1 to unit 2 in Economics did not impact the scores significantly. The small sample size in the Econ2 work was completed by students who regularly put forth effort and complete work. This anecdotal evidence was a key in understanding possible reasons for the differential in scores between the groups on both units.

#### Class Attendance and End of School Effort.

At the end of a school year many events affect the performance of high school students, especially seniors. Seniors are often away from the building for field trips, senior day events, meetings with college reps, and a whole plethora of other things. Not to mention, the concentration levels of both teachers and students begin to wane as the year draws to a close. The evidence for learner distraction in the Economics samples is noticeable in the data collected. Not only did the sample size decrease by two-thirds, scores also decreased between the first and second units in Economics in overall scores,

Rubric Item 3 and Rubric Item 5. This, along with the informal teacher observations of student effort on all types of instruction, classroom interactions, and work completion favors student effort as a plausible and most probable cause for differences in gain. However, these differences were not large enough to produce a significant difference across classes when analyzed in the ANOVAs, which suggests this potential confound is not enough to undermine the conclusion that MEL instruction was the primary cause for students' improved writing and critical thinking skills.

When focusing on student effort, the World History group had less distractions, more engagement, greater effort in attending and participating in intervention time, and a higher work completion percentage. For this reason, the effort put forth by students was measured anecdotally, but did provide key insight into the effect of the MELs.

#### Limitations of the Study

When examining this study, several limitations were discovered following its completion. While there are several smaller limitations to this study, two major limitations were explored. These two limitations were a lack of a control group and the quantitative inability to measure student effort. The limitations did not directly affect the impact of the MELs, but did limit the strength of the data represented in the study.

When reflecting on the lack of a control group, it was decided in the construction of the study to ensure all students were exposed to the same critical thinking instruction and MEL usage instruction out of equity for all learners. The biggest reason for not having a control group was because it would have created inequitable learner outcomes for students, especially with the focus of this study catering on creating critical thinking

connections. Hence, the decision was made to have only experimental groups. While the lack of a control does limit the strength of the data collected, the study still found significance between the usage of MELs and critical thinking abilities of students on open-ended prompts.

One possible way to resolve the concern for not having a focus group is to create a future study using the same courses. However, this future study would ensure that each course has one control and one experimental group. This would allow for a cross-over study to measure the growth between the two groups.

The ability to measure student effort on the learning and application of the skills acquired in this study is difficult to quantify. With the study taking place at the end of the school year, students missed school for a multitude of reasons, especially during the final eight weeks of school, while MEL instruction was taking place. This included, but was not limited to field trips, sporting events, graduation practice, and school assemblies. Not only did students miss instruction, students experienced the traditional end of the year episodes lacking motivation, especially students in the Economics class. While this could be observed by the researcher, there was no way to quantify the impact it had on the study.

#### Implication for Practice

As was noted by many of the studies examined in the literature review of this study, the use and overuse of graphic organizers as educational aids has done little to ensure that the students using graphic organizers engage in the material beyond the retrieval level. In all actuality, the students who use graphic organizers regularly use

them simply to memorize key vocabulary words, organize their own retrieval level thoughts, and sort information. While this may be helpful to students understanding information at a surface level, for them to truly master the learning target and reach a higher level of complexity and taxonomy within the content, students must be engaged in critical thinking skills and instruction.

When examining the research conducted by Lombardi over multiple studies, the concept of using MELs to engage students in critical thinking to examine specific evidences and the evidences contextual levels of support for the learning target (model), it becomes apparent that graphic organizers, when redesigned allow for students to interact with content at a higher levels of thinking. This was true of this study as well. Students' previous experience with graphic organizers had been typical as that of students in many of the studies explored in the literature review. These experiences included using organizers to simply memorize lists, generate basic ideas to explore, and sorting information into manageable chunks. However, by incorporating MELs into instruction following a similar procedure to that of the Lombardi studies, with only slight procedural changes, similar results were achieved in this study. What particularly strengthens this approach for using MELs is that the present results were achieved in a different content area; namely Social Studies. However, an even more general implication from this study includes the idea that fostering critical thinking in any subject area must include a teaching style that is compatible with critical thinking. Therefore, MELs are likely one instructional tool from a collection for fostering critical thinking. What is most

impressive about MELs is that they show how graphic organizers can be used in the classroom to go beyond basic recall and simple comprehension.

The best approach to using the MEL process across curriculums involves the precision of aligning learning targets (models) with specific contextual evidence that have varying levels of support. By creating varying levels of support in the contextual evidence, students must truly engage with both the evidence and the content presented in class. It is key to ensure that a multitude of instructional strategies are used in coordination with strategies of differentiation to engage all learners. The key to building strategies and skills in critical thinking includes presenting open-ended problems to students with multiple possible answers supported by the students' understanding of the class content. Oftentimes, as was the case with the learning target for the four units in this study, open-ended assessments that truly require mastery of the content are necessary to assess the ability of students to connect content to the learning target phrased as an open-ended writing prompt. These prompts required students to engage with content and evaluate evidence in the level of support required to build a strong argument for their own written responses.

MEL usage appears to be most beneficial in courses that require investigation, inquiry, and open-ended, writing prompts. Courses such as English/Language Arts, Science, and Social Studies tend to be the first courses considered when thinking about these descriptors, yet all courses require a level of critical thinking to be successful. The idea of using MELs to develop engagement and investigation are not limited to Science and Social Studies, where studies have been completed, but could be utilized in almost

any academic setting and course. The key to the successful use of MELs, according to the data gathered from this study and the study by Bickel and Lombardi (2016), is quality instruction on the appropriate use of MELs. This produces a two-fold benefit to students. Not only does it allow students to investigate the contextual evidence, but also engages them in the process of thinking critically about the importance evidence plays in supporting their open-ended responses. For this reason, it would be necessary for future researchers to study the effects of MELs in other content, especially Math since instructional strategies and content in that discipline have begun to shift from a procedural to conceptual approach.

### Conclusion

The ability to think critically and problem solve is an essential skill for students to master, especially as they move beyond the high school building and begin their journey into post-secondary life. For this reason, this study focused on the impact of differentiated instruction in content and direct instruction on using MELs. The instructional benefit of focusing instruction in a differentiated learning environment allows students to build skills, not only in the content, but also in investigation and connecting content to specific learning targets. This is not a new concept, but has been difficult for many teachers to master, especially given the growing amount of content and duties placed on already overburdened teachers. Students are most often directly affected by this issue, especially in terms of mastering content and skills. Teachers, who regularly push the limits of time as it is, often sacrifice student mastery for student “good enough”, causing student academic struggles to magnify. However, if teachers are able to use

highly engaging instructional strategies with differentiated instructional methods, including MELs, they can maximize their contextual coverage and ensure student learning is not being sacrificed by the typical time constraints teachers are under.

There are many benefits of students engaging in highly effective and differentiated instruction, including deeper conceptual understanding, instructional strategies aimed at “meeting the needs of all students”, and a more transparent picture of student assessment data by the teacher. However, a big impact for effective and differentiated instruction in this study was the amount of time that students received content and critical thinking skills through multiple instructional strategies. These instructional strategies had been used previously in that academic year, with differentiated instruction, yet did not yield the results the inclusion of the MEL instruction and the processing of critical thinking concepts did. With this stated, both supported anecdotally and by data, it can be argued the inclusion of MELs and critical thinking instruction are important keys to student growth for answering open-ended prompts that require contextual support.

When implementing the instructional strategies that improve student understanding and allow for students to truly master content, it is important to have an understanding of the students’ baseline knowledge. While that seems a “no-brainer” in education, many teachers fail to realize the impact of the pre-assessment. According to the research conducted on critical thinking, less than half of the teachers use pre-assessment regularly. Instead, they often relied on the students’ assessment scores from the summative assessment at the end of the previous unit of instruction. While this may



seem like the logical choice, data from previous assessments only shows a small portion of the students' knowledge on the next unit of study. Oftentimes, the next unit of study has little "overlap", and if the teacher assumes students understand the concept because of mastery of the previous skill or contextual concept, gaps will likely emerge in student learning and understanding.

The pre-assessment process allows teachers to better plan and regulate for differentiation, small groups, and specific instructional strategies that move students, no matter the starting point on the taxonomy scale, towards that of analysis and other modes of higher level thinking. Coupling a pre and post assessments approach with MEL instruction, raised levels of growth in students that the pre and post assessment model alone did not achieve. The inclusion of these methods and materials ought to be more widely adopted in classes where critical thinking is an important learning outcome.

## REFERENCES

- Bickel, E. S., & Lombardi, D. (2016). Assessing students' evaluation on the model evidence link diagram. *The Earth Scientist, XXXII*(2), 31-36.
- Bulgren, J. A., Deshler, D. D., Lenz, B. K., Marquis, J. G., & Schumaker, J. B. (2011). The effectiveness of a question-exploration routine for enhancing the content learning of secondary students. *Journal of Educational Psychology, 103*(3), 578+.
- Clarke, J., & Martell, K. (1994). Sequencing graphic organizers to guide historical research. *The Social Studies Journal, 85*, 70-75.
- Dexter, D. D., & Hughes, C. A. (2011, Winter). Graphic organizers and students with learning disabilities: A meta-analysis. *Learning Disability Quarterly, 34*(1), 51+.
- Doyle, C. S. (1999). *The use of graphic organizers to improve comprehension of learning disabled students in social studies* [Unpublished master's research project]. Kean University, 42. 84.
- Ennis, R. H. (2011). Critical thinking: Reflection and perspective. *Inquiry, 26*, 1 and 2.
- Fordham, N. W., Wellman, D. & Sandmann, A. (2002). Taming the text: Engaging and supporting students in social studies readings. *The Social Studies Journal, 93*(4), 149-158.
- Fertig, G. (2008). Using biography to help young learners understand the cause of historical change and continuity. *The Social Studies Journal, 99*(4), 147-154.
- Gallavan, N. P., & Kottler, E. (2007). Eight types of graphic organizers for empowering social studies students and teachers. *The Social Studies Journal, 98*(3), 117-128.
- Greene, J. A., & Yu, S. B. (2015). Educating critical thinkers. *Policy Insights from the Behavioral and Brain Sciences, 3*(1), 45-53.
- Griffin, C. C., Malone, L. D., & Kameenui, E. J. (2001). Effects of graphic organizers instruction on fifth grade students. *The Journal of Educational Research, 89*, 98-107.
- Iowa Department of Education. (2009). Essential skills sets and concepts of the Iowa core curriculum. *Iowa CORE Curriculum Guide*, 1-5.
- Key, L., Bradley, J. A., & Bradley, K. S. (2010). Stimulating instruction in social studies. *The Social Studies Journal, 101*, 117-120.

- Lindquist, T. (1997). Help kids manage facts with graphic organizers. *Instructor-Primary, 107*, 72.
- Lombardi, D., Bickel, E. S., Brandt, C. B., & Burg, C. (2017). Categorising students' evaluations of evidence and explanations about climate change. *International Journal of Global Warming, 12*(3), 313.
- Marzano, R. J. (2010). Representing knowledge nonlinguistically. *Educational Leadership, 67*, 2-4.
- Mastropieri, M. A., Scruggs, T. A., & Graetz, J. E. (2003). Reading comprehension instruction for secondary students: Challenges for struggling students and teachers. *Learning Disability Quarterly, 26*, 103-116.
- Murawski, L. M. (2014). Critical thinking in the classroom...and beyond. *Journal of Learning in Higher Education, 10*(1), 25-30.
- National Council for the Social Studies (NCSS). (2013). The college, career, and civic life (C3) framework for social studies state standards. *Guidance for Enhancing the Rigor of K-12 Civics, Economics, Geography, and History*, 35-40.
- Northeastern Illinois University. (2006). *NEIU critical thinking rubric: Adapted from Washington State University's critical thinking project* [Word document]. Resources. <https://www.neiu.edu/about/office-of-institutional-research-and-assessment/assessment/resources>
- Passmore, J. (1967). On teaching to be critical. *Education and the Development of Reason, 309-322*.
- Reagan, R. (2008). Direct instruction in skillful thinking in fifth-grade American history. *The Social Studies Journal, 217-222*.
- Rinehart, R., Golan Duncan, R., & Chinn, C. (2014). Teacher's toolkit: A scaffolding suite to support evidence-based modeling and argumentation. *Science Scope, 038*(04).
- Richardson, J. T. E. (2011). Eta squared and partial eta squared as measurements of effect size in educational research. *Educational Research Review, 6*, 135-147.
- Robinson, D. H., Katayama, A. D., Beth, A., Odom, S., Ya-Ping, H., & Vanderveen, A. (2006). Increasing text comprehension and graphic note taking using a partial graphic organizer. *Journal of Educational Research, 100*(2), 103-111.

Weisman, E. M. & Hanson, L. (2007). Strategies for teaching social studies to English-language learners at the elementary level. *The Social Studies Journal*, 98(5), 180-184.

## APPENDIX A

Appendix A defines key words that have a specific meaning in this dissertation. The working definitions of these words are described in more depth within the dissertation itself.

**MEL:** The Model-Evidence-Link (MEL) diagram, created by Dr. Douglas Lombardi (2016), is a classroom activity that integrates critical thinking into science curriculum. However, in this dissertation, MELs were used in the same fashion in a Social Studies classroom. When using the MEL, students use scientific evidence to evaluate and interrogate competing models based on their understanding of contextual evidence.

**Sponge and Puke:** Rote memorization of key words, dates, or phrases that are quickly memorized and then expelled from the brain through a multiple choice, fill in the blank, or word bank response. In this process, knowledge does not move from short term to long term memory, nor does the students interact with the content using the critical thinking process or interrogation process

**Critical Thinking:** Critical thinking is attributed more to the understanding of content knowledge and the ability to interact with it, than the measurement of intelligence

**Graphic Organizer:** A graphic organizer, also known as a knowledge map, concept map, story map, cognitive organizer, advance organizer, or concept diagram is a instructional strategy or tool that uses visual symbols or representation to express knowledge and concepts through relationships between them

**C3 Framework:** The C3 framework focuses on the areas of College, Careers, and Civic Life preparedness in order to prepare students for the real world and post-secondary

education. Within the C3 framework, standards focus on creating meaningful instruction that addresses student abilities to use social studies instruction to prepare students for real-world problem solving and critical thinking beyond the wall of the traditional school setting.

## APPENDIX B





Appendix B showcases the four MELs to be used with the World History and Economics classes. The students are presented with two learning targets (Models A and B) and four pieces of evidence. At the conclusion of the content instruction featuring the learning targets and pieces of evidence, the students will complete the MEL. Differing styles of lines will be used to make connections between the evidences and the learning targets. These will then be used by students in preparation for the open-ended writing assessment to be completed at the end of the six-week time frame.

Figure 1. World History MEL used with Unit 1: Tension in the Middle East

If you worked with other students, their name(s): \_\_\_\_\_

**Directions:** Draw 2 arrows from each evidence box, one to each model. You will draw a total of 8 arrows.

**Key:**

	The evidence <b>supports</b> the model
	The evidence <b>STRONGLY supports</b> the model
	The evidence <b>contradicts</b> the model (shows its wrong)
	The evidence has <b>nothing to do with</b> the model

<p><b>Evidence #1</b></p> <p>The support and sale of weapons to the radical groups in the Middle East to stop the Soviet invasion of Afghanistan, lead to the use of these weapons on American soldiers at the beginning of the War on Terror</p>	<p><b>Model A</b></p> <p>The United States has had a major role in tensions between Middle Eastern countries following the second World War, but the conquest for foreign oil has had the biggest impact on America's involvement in the Middle East</p>	<p><b>Evidence #3</b></p> <p>Dubai has made its countries wealth off of the sale of oil to developed countries like the United States. For this reason, Dubai finds it necessary to remain independent in Middle Eastern conflicts</p>
<p><b>Evidence #2</b></p> <p>Saudi Arabia stood by and watched America gave support and sell weapons to radical groups in the Middle East. It was well known that the Iran contra scandal allowed Saudi Arabia to remain powerful in the face of American opposition</p>	<p><b>Model B</b></p> <p>Middle Eastern countries such as Dubai and Saudi Arabia control the majority of wealth in the Middle East, yet do little to stop the infiltration of radical terrorists and UN interventions in the region, leading to distrust by the UN in these countries</p>	<p><b>Evidence #4</b></p> <p>The creation of Israel and Palestine are directly related to the tension over Holy places between the three main Monotheisms of the World.</p>







Figure 2. World History MEL used with Unit 2: The Ever-Changing World

If you worked with other students, their name(s): \_\_\_\_\_

**Directions:** Draw 2 arrows from each evidence box, one to each model. You will draw a total of 8 arrows.

**Key:**

	The evidence <b>supports</b> the model
	The evidence <b>STRONGLY supports</b> the model
	The evidence <b>contradicts</b> the model (shows its wrong)
	The evidence has <b>nothing to do with</b> the model

**Evidence #1**

Colonialism died in the mid 20th Century; however, revolt and reform, especially in underdeveloped countries has caused instability within trade, alliances, and the United Nations

**Model A**

With the reforms, regime changes, and turbulence around the world, especially in the underdeveloped nations, political unrest is a major issue. This issue is often caused by lack of structure in the government and country as a whole

**Evidence #3**

Climate change has been occurring on the Earth for millions of years. It is difficult to say the impact industrialization has on the term "Global Warming"

**Evidence #2**

Underdeveloped countries, especially those just beginning to industrialize are adding to the "Greenhouse Effect" accelerating climate change

**Model B**

Climate change is happening, especially in the polar regions of the world. Industrialized countries have put environmental plans in place to limit greenhouse emissions, but underdeveloped countries have not.

**Evidence #4**





Underdeveloped countries are industrializing like countries did in the late 1700's, the time at which scientist noticed a major increase in climate change

Figure 3. Economics MEL used with Unit 1: Government Involvement

If you worked with other students, their name(s): \_\_\_\_\_

**Directions:** Draw 2 arrows from each evidence box, one to each model. You will draw a total of 8 arrows.

**Key:**

	The evidence <b>supports</b> the model
	The evidence <b>STRONGLY supports</b> the model
	The evidence <b>contradicts</b> the model (shows its wrong)
	The evidence has <b>nothing to do with</b> the model





<p><b>Evidence #1</b></p> <p>Society needs both those who are financially responsible and those who have issues with credit to function properly in a free market economic system</p>	<p><b>Model A</b></p> <p>Personal finance is important in terms of being a contributing member of society. This includes, paying taxes, understanding debt, and consciously choosing a career and lifestyle path that is within your financial understanding and ability.</p>	<p><b>Evidence #3</b></p> <p>Financial planning is an important skill to learn and use as an adult. There are many ways to learn and become educated about responsible financial choices.</p>
<p><b>Evidence #2</b></p> <p>Taxes are the single biggest factor in ensuring the government has enough credit to create a budget that helps all citizens. This includes things like social security and welfare</p>	<p><b>Model B</b></p> <p>Income, budgeting, paying taxes, and understanding debt are key in understanding personal finance. It is important to gather the required knowledge to make informed decisions on purchases and spending.</p>	<p><b>Evidence #4</b></p> <p>Understanding how to live within a budget allows a person to make strong, responsible financial decisions that help contribute to the economy</p>

Figure 4. Economics MEL used with Unit 2: Personal Finance

If you worked with other students, their name(s): \_\_\_\_\_

**Directions:** Draw 2 arrows from each evidence box, one to each model. You will draw a total of 8 arrows.

**Key:**

	The evidence <b>supports</b> the model
	The evidence <b>STRONGLY supports</b> the model
	The evidence <b>contradicts</b> the model (shows its wrong)
	The evidence has <b>nothing to do with</b> the model

**Evidence #1**

Society needs both those who are financially responsible and those who have issues with credit to function properly in a free market economic system

**Model A**

Personal finance is important in terms of being a contributing member of society. This includes, paying taxes, understanding debt, and consciously choosing a career and lifestyle path that is within your financial understanding and ability.

**Evidence #3**

Financial planning is an important skill to learn and use as an adult. There are many ways to learn and become educated about responsible financial choices.

**Evidence #2**

Taxes are the single biggest factor in ensuring the government has enough credit to create a budget that helps all citizens. This includes things like social security and welfare

**Model B**

Income, budgeting, paying taxes, and understanding debt are key in understanding personal finance. It is important to gather the required knowledge to make informed decisions on purchases and spending.

**Evidence #4**

Understanding how to live within a budget allows a person to make strong, responsible financial decisions that help contribute to the economy

## APPENDIX C

Appendix B is the rubric that will be used by both raters in the assessment of the students' open-ended responses on post the pre and post assessments. The rubric examines and evaluates the students' writing sample on both writing and content knowledge.

Figure 5. Critical Thinking Rubric used to score students' open-ended written responses on both the pre and post assessment.

NEIU Critical Thinking Rubric\* (revised on 10/23/06)

Quality Criteria	No/Limited Proficiency (1 point)	Some Proficiency (2 points)	Proficiency (3 points)	High Proficiency (4 points)	Rating (1,2,3,4pts)
1. Identifies & explains <b>ISSUES</b>	Fails to identify, summarize, or explain the main issue.  (AND/OR)  Represents the issues inaccurately or inappropriately.	Identifies main issues but does not summarize or explain them clearly or sufficiently.	Identifies, summarizes, and briefly explains the main issues, but fails to mention any implicit issues.	Clearly identifies, summarizes, and explains main issues and identifies embedded or implicit issues, addressing their relationships to each other.	
2. Recognizes stakeholders and <b>CONTEXTS</b> (i.e., cultural/social, educational, technological, political, scientific, economic, ethical, personal experience)	Fails to accurately identify and explain any empirical or theoretical contexts for the issues.  (OR)  Presents problems as having no connections to other conditions or contexts.	Shows some general understanding of the influences of empirical and theoretical contexts on stakeholders, but does not identify any specific ones.	Correctly identifies the empirical and most theoretical contexts relevant to the main stakeholders.	Correctly identifies the empirical and theoretical contexts relevant to the main stakeholders, and identifies minor stakeholders and contexts showing the tensions or conflicts of interest among them.	
3. Frames personal responses and acknowledges other <b>PERSPECTIVES</b>	Fails to formulate a personal point of view and fails to consider other perspectives.	Formulates a vague personal point of view and/or vague alternative points of view.	Formulates a clear personal point of view and considers some other perspectives.	Formulates a clear personal point of view and addresses relevant perspectives successfully.	

Quality Criteria	No/Limited Proficiency (1 point)	Some Proficiency (2 points)	Proficiency (3 points)	High Proficiency (4 points)	Rating (1,2,3,4pts)
4. Identifies & evaluates <b>ASSUMPTIONS</b>	Fails to identify and evaluate any of the important assumptions behind the claims and recommendations made.	Identifies some of the most important assumptions, but does not evaluate them for plausibility or clarity.	Identifies and briefly evaluates the important assumptions.	Identifies and carefully evaluates the important assumptions.	
5. Identifies & evaluates <b>EVIDENCE</b>	Fails to correctly identify data and information that counts as evidence for truth-claims (AND/OR) fails to evaluate its credibility.	Correctly identifies data and information that counts as evidence but fails to highlight its relative importance and/or link them with theoretical concepts and frameworks.	Correctly identifies important evidence, highlights its relative importance, and makes an attempt at linking evidence to theoretical concepts and frameworks.	Correctly identifies and rigorously evaluates important evidence, successfully linking the evidence to theoretical concepts and frameworks while providing new or alternative data or information for consideration.	
6. Identifies & evaluates <b>IMPLICATIONS</b> ("What does this mean?")	Fails to identify implications, conclusions, or consequences of the issue.	Suggests some implications, conclusions, or consequences of the issue.	Identifies and briefly evaluates many implications, conclusions, or consequences of the issue.	Identifies and thoroughly evaluates implications, conclusions, or consequences of the issue.	

\* Adapted from Washington State University's *Critical Thinking Project*

## APPENDIX D

Appendix C is the open-ended writing prompts that are directly related to the instructional content and both, the learning targets and evidence presented on the MELs. These writing prompts are directly related and created using Iowa CORE learning standards. These are the prompts that students will use to create the open-ended writing samples that will be evaluated using paragraph rubric (Appendix C).

### **pre-assessment Unit 1 World History**

**Directions:** Answer the following question with a multi-paragraph response. Be sure to use specific supports for your thesis statement. It is also important to use correct grammar, spelling, and sentence structure.

We have discussed many issues and conflicts that have occurred throughout the past century around the world, including the Middle East. Why is the Middle East so important, especially to developed countries like the United States? Also, why do countries that are wealthy, like Saudi Arabia and Dubai avoid getting involved in policing radicals living in less developed Middle Eastern countries? Explain.

*SS-WH.9-12.17. Evaluate the consequences of human-made catastrophes on global trade, politics, and human migration*

### **pre-assessment Unit 2 World History**

**Directions:** Answer the following question with a multi-paragraph response. Be sure to use specific supports for your thesis statement. It is also important to use correct grammar, spelling, and sentence structure.

The idea of climate change and global warming have been debated for the past 25 years or so, especially in the wake of the developed world filtering industrial waste and moving towards Green Energy initiatives. However, developing countries and those countries that do not participate in the global pollution plan are continuing to contribute to climate change. In what ways is it important for the “health” of the earth to regulate and educate the new industrial revolution in underdeveloped countries? Explain.

*SS.9-12.7. Construct arguments using precise and knowledgeable claims, with evidence from multiple sources, while acknowledging counterclaims and evidentiary weaknesses.*

### **pre-assessment Unit 1 Economics**

**Directions:** Answer the following question with a multi-paragraph response. Be sure to use specific supports for your thesis statement. It is also important to use correct grammar, spelling, and sentence structure.

Last semester, in Government class, the importance of checks and balances in the branches of government were explored. In the American economic system, similar checks and balances exist to ensure that the government has the ability to adjust and support the Free Trade system of the American economic system. What role does the government play in ensuring Free Enterprise exists in America? In addition, why is it important that the government has the ability to stimulate the economy if it becomes stagnant? Explain.

*SS-Econ.9-12.19. Describe the roles of institutions such as clearly defined property rights and the rule of law in a market economy.*

### **pre-assessment Unit 1 Economics**

**Directions:** Answer the following question with a multi-paragraph response. Be sure to use specific supports for your thesis statement. It is also important to use correct grammar, spelling, and sentence structure.

For an economic system to work successfully, it is important for citizens to have a good understanding of personal finances; however, it is equally important that personal finance successes and difficulties contribute to ebbs and flows in the markets. Explain the impact on the economic system of America for individual citizens to understand personal finance concepts such as taxes, interest rates, and personal monetary choices. Also, why is it important for individuals to be educated and gain experience in personal finances to be a successful contributor to the economy?

*SS-FL.9-12.14. Evaluate entrepreneurship, career choices and the effect on the standard of living. (21st century skill)*