FOSTERING GRADUATE STUDENT CREATIVE PROBLEM SOLVING
IN A PROFESSIONAL MILITARY EDUCATION CONTEXT

by
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Abstract

In military contexts, a tension exists between the need for rapid, unquestioning obedience to orders, especially early in one’s career, and the need for senior leaders to solve complex problems creatively. For officers in the Marine Corps, a key milestone in their careers is the Marine Corps’ Command and Staff College, an intermediate-level professional military education master’s degree program. In 2015, the College, and the wider Marine Corps University community, established a plan to improve student creative problem solving; however, the plan did not meet its outcome goals by 2021.

The purpose of this study is twofold. First, using a convergent parallel mixed methods design, this study examined factors related to creative problem solving and their application to Command and Staff College curriculum. Key results of interviews, surveys, and secondary data analysis included the perceived need for additional time for students to think creatively, and the need to address the tension between authoritarian thinking and the imperative to develop new creative solutions. The second part of this study examined an intervention designed to give students more time to think and to give them structural, metacognitive supports for their thinking. Using a quasi-experimental design, the two key factors of concern for the study were metacognition and creative problem solving.

Improvements in the students’ metacognitive abilities were expected to lead to improvements in their creative problem-solving ability. Quantitative results showed no significant improvement in creative problem solving while there was actually a significant decrease in perceived metacognitive ability for both the comparison and intervention groups. According to explanatory interviews, one key factor in these results may have been the use of a perception survey, in which decreases in one’s perception of one’s metacognitive ability might mask actual improvements in real metacognitive ability. Another factor that emerged from the explanatory interviews was the need for the intervention to be more fully integrated across the whole curriculum. This study underscores the difficulty of making significant changes to student creative problem solving, especially in a military community. Further study could examine the relationship
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between perceptions of metacognitive ability and actual metacognitive ability.

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Keywords: creative problem solving, military education, metacognition, authoritarianism, divergent thinking
Dedication

This dissertation is dedicated to my wife, Ana, for her support and inspiration. Without your encouragement, I may never have started. Your creativity inspires me. To my children, Toma and Ava, thanks for being in my “study parties.” You helped me finish.
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Disclaimer

The Opinions and conclusions expressed herein are those of the author and do not necessarily represent the views of the Marine Corps, the Marine Corps University, or any other government agency.
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CHAPTER 1: LITERATURE REVIEW

Military service members face an unpredictable and uncertain world that requires them to think creatively in order to solve complex problems (Berger, 2019; Franke, 2011; Joint Chiefs of Staff, 2020). Within the military education system and the larger national security community, failures in Iraq and Afghanistan as well as the growing capability of other nations’ militaries, many leaders are convinced that the U.S. professional military education community needs to be re-invigorated (JCS, 2020; Department of Defense, 2018). Moreover, the increasing complexity of the global environment requires increasing the creative problem-solving ability of military officers (Berger, 2019). On the other hand, according to one compilation of studies on military creativity, “There is an inherent tension between encouraging creativity within the Armed Forces and maintaining military discipline” (Bryant & Harrison, 2019, p.1).

Critics might question why the U.S. military is focusing on creativity rather than just power or military strength. There are two main reasons that military strength is no longer sufficient for today’s military success. First, as mentioned above, military strength has not been sufficient to ensure success even against foes with much less combat power. The wars in Afghanistan and Iraq demonstrated that the U.S. possesses short term military superiority vastly exceeding the strength of most potential military competitors and, at the same time, that military superiority was not sufficient to bring ultimate success. Secondly, the U.S. now finds itself, for the first time in decades, faced with a potential peer competitor (China) against whom overwhelming military force is no longer a given (Department of Defense, 2018). For this reason, military leaders at the highest levels have begun to advance the claim that U.S. military success depends upon the U.S.
military’s ability to outthink future opponents (Berger, 2019; USMC, 2020a; USMC, 2020b; Department of the Navy, 2020; JCS 2020). Creative thinking is perhaps the most important element of outthinking our opponents (USMC, 2020a). For this reason, several strategic guidance documents have called for the military professional education community to emphasize creative problem-solving (USMC, 2020a; Department of the Navy, 2020).

Within the current U.S. professional military education community, there are five major graduate institutions: National Defense University, Army University, Air University, Naval War College, and Marine Corps University (MCU). MCU is composed of six colleges--three are degree granting educational institutions. They are called Command and Staff College (CSC), School of Advanced Warfighting, and Marine Corps War College. These three colleges are officer resident colleges that offer Master’s degrees. Each of these resident degree-granting colleges has one curriculum, there are no specializations or concentrations, and the curricula is focused on a particular moment in an officer’s career. This dissertation focuses specifically on intermediate level professional military education at MCU’s resident CSC, which awards a Master of Military Studies to military officers and other government professionals with approximately 10-15 years of service.

**Historical precedent**

Throughout its history, the Marine Corps has proclaimed a high regard for the power of creative thinking. The Marine Corps’ seminal “doctrinal” publication, *Warfighting*, which is meant to serve as the theoretical foundation of everything the Marine Corps does, explicitly extols the virtues of creativity and states that “professional
military education is designed to develop creative, thinking leaders” (USMC, 1997a, p. 61). From early in their careers, Marines are told stories of some of the great Marine thinkers throughout Marine Corps history.

Before becoming a university, the schools now known as Expeditionary Warfare School and CSC at MCU were known as the Marine Corps Schools and some of the most important Generals in early twentieth century Marine Corps history debated their purpose. For instance, Major General John A. Lejeune, World War I Commander and namesake of Camp Lejeune, the largest U.S. Marine base on the east coast of the U.S., argued that the Schools should help all Marines think in the same way (Gudmundsson, 2020). On the other hand, Lieutenant General Breckinridge, who served as Commandant of the Marine Corps Schools twice and is the namesake for the headquarters building at MCU, argued that the purpose of a military college should be to facilitate the original thinking of military officers (Breckinridge, 1929; Gudmundsson, 2020).

Another legendary Marine thinker is Lieutenant Colonel Pete Ellis. He is the namesake for the building at MCU that formerly housed CSC. Additionally, both the Marine Corps Association and MCU sponsor separate essay contests named in his honor (MCA, n.d.; MCU, 2020a). Like many of his contemporaries, he was a man of flawed character, who exhibited racist and imperialist affinities; and he died young of alcoholism (Ballendorf & Bartlett, 1997). Still, the Marine Corps of today can learn from his example as a creative strategist. Prior to World War I, Ellis studied the amphibious warfare at the Naval War College for a year (Ballendorf & Bartlett, 1997; Mills, 2020). He wrote several papers on the topic of amphibious warfare and was retained for a second year as a faculty member (Ballendorf & Bartlett, 1997).
Ellis then served in World War I as an operations officer, where he attained the temporary rank of Lieutenant Colonel. Following the war, he reverted to the rank of Major and began research on amphibious war in the Pacific (Ballendorf & Bartlett, 1997). In 1923, he participated in an experimental landing exercise at Culebra, Puerto Rico, which the Navy had designed to examine lessons learned from the failed British landing at Gallipoli (Ballendorf & Bartlett, 1997; Murray, 2020).

In today’s military, predicting the next war is usually considered to be impossible. However, in 1921, now Major Ellis, published a manual called *Advanced Base Operations in Micronesia*, which successfully predicted a war against Japan and charted, in strategic outline, the course of the U.S. military campaign in the Pacific during World War II (Ballendorf & Bartlett, 1997; Ellis, 1921; Mills, 2020). Ellis enjoyed the patronage of the influential Marines of the time, including Major General Lejeune, until his death in Palau in 1923 while conducting additional research into suspected Japanese military actions there (Ballendorf & Bartlett, 1997).

Lieutenant General Breckinridge commanded the Marine Corps Schools from 1928-1929 and again from 1932-1935, and he incorporated the work of Ellis and others into the school’s curriculum (Gudmundsson, 2020). In fact, Breckinridge actually suspended the curriculum for an entire year in order for all the students and faculty to collaborate to create the *Tentative Manual for Landing Operations*, published in 1934 (Mills, 2020). The work of the Marine Corps Schools during the interwar period was instrumental in the nations’ eventual victories over Germany and Japan in World War II.

The example that Ellis set is especially relevant to the current study because of three factors. First, he began his study of amphibious warfare at the Naval War College.
Second, he thought creatively at a strategic level, not just a tactical level. Third, at the
time that he wrote *Advanced Base Operations in Micronesia*, he held the rank of Major,
which is the rank of most of the student participants in the current study. Now, nearly a
century later and after decades of desert warfare, the Marine Corps is returning to the
concept of advanced basing in the Pacific and amphibious warfare, while the most recent
former Commandant of the Marine Corps, General David Berger, led a redesign of the
Force and called for Marines to innovate in this area (Berger, 2019). Thus, the Marine
Corps can find inspiration in its past as it fosters the next generation of innovative Marine
Corps thinkers and operating concepts.

**Context of Marine Corps Professional Military Education**

As described above, all students at CSC, the focus of this study, take almost
exactly the same curriculum. They are each assigned to a 12-13 student seminar group.
Aside from two electives worth two total semester credits and a final thesis worth three to
five semester credits, the students remain the in same seminar group throughout the full
academic year, studying all subjects together. In addition to the above electives and
thesis, students take 36 credits of coursework within the following four main subject
areas: leadership, warfighting, war studies, and security studies. One military faculty
member and one primary civilian faculty member lead each seminar group. The civilian
faculty specialize in either war studies or security studies. For these two subjects, the
civilian faculty will periodically cross over to another conference group to teach lessons
specifically related to their areas of expertise. The war studies faculty members usually
specialize in military history and teach lessons related to that subject matter, while the
security studies faculty might specialize in international relations and teach lessons related to that subject area.

Military faculty are primarily responsible for the courses on leadership and warfighting. The CSC curriculum, and the warfighting courses in particular, focus on planning at the operational level of war. The levels of war, from lowest to highest, are tactical, operational, and strategic; at the operational level military officers “conceive, focus, and exploit a variety of tactical actions in order to attain a strategic goal” (USMC, 1997, p. 8). Officers entering the middle point of their career are expected to understand operational warfighting, hence the moniker of “intermediate level education” for CSC (Chairman of the Joint Chiefs of Staff, 2020)

In order to meet the creative needs of the military and address the tension between creativity and discipline, MCU developed a Quality Enhancement Plan entitled “Strengthening Leadership through Enhanced Creative Problem Solving” (MCU, 2015, p. 1). MCU established a goal that 80% of its students would produce “creative” work by the end of the academic year, using a modified version of the Association of American Colleges and Universities’ creative thinking VALUE rubric (AAC&U, 2009). See Appendix A. Unfortunately, the University, as a whole, and CSC, in particular, have fallen well short of that goal each year (MCU, 2021a). Therefore, the problem of practice for this study is the fact that military officers attending MCU demonstrate continuing levels of creativity below the University’s goals and the perceived needs of the U.S. national security community. Put more positively, the problem of practice is how to foster creative problem-solving amongst graduate students in this professional military education program at CSC.
Components of Creative Problem Solving

This study draws on Amabile’s (1998; Amabile & Pratt, 2016) componential model of creativity and innovation in organizations, which focuses on the interactions between three main factors at the organizational and individual levels (See Figure 1.1).

Figure 1.1 Amabile’s model of creativity and innovation (Amabile & Pratt, 2016, p. 161).
A key feature of the model is the interaction between individual/small group creativity and organizational innovation, which is the implementation of creative ideas (Amabile & Pratt, 2016). At the individual level, the three factors are the motivation to be creative; skills, resources, and knowledge in the area of the task; and skills related to creativity (Amabile, 1988; Amabile & Pratt, 2016). These three factors are mirrored by similar factors at the organization level (Amabile, 1998).

At the level of the individual or small team, Amabile and Pratt’s (2016) model shows how creativity is a product of the interaction between motivation, creative processes, and skills in the task. In turn, creativity feeds innovation, which is itself a product of the interaction between motivation, innovative processes, and resources in the domain of the task. The arrow from innovation to creativity signifies that an innovative work environment encourages creativity, which then feeds innovation, creating a reinforcing positive loop. The model depicts the external environment influencing the organization, but one might also draw an arrow from the external environment to the individual or small team, which are also influenced by the external environment. Finally, circles at the individual level interact with corresponding circles at the organizational level so that, for instance, resources in the task domain interact with skills in the task domain. Likewise, organizational and individual motivation interact, and innovation management at the organizational level interacts with creative processes at the individual level.

For the purposes of this study, creativity is defined as the operationalization of novel ideas that are also useful (Amabile, 1998; Grant & Smith, 2018; Kalyaap, 2018; Smaliukienė & Survilas, 2018). In fact, the 2015 MCU Quality Enhancement Plan
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specifically referred to creative problem-solving rather than simple creativity in order to make clear that the creativity of the students must also contribute to solving problems of interest to the U.S. national security community (Berger, 2018; MCU, 2015).

Furthermore, the MCU Quality Enhancement Plan focused on reinforcing elements of creativity and removing inhibitions to creativity that are part of MCU graduate students’ reasoning (MCU, 2015). MCU used a construct for creativity that focuses on professional creativity in student products and included components related to problem-solving, leadership, teamwork, and communication (MCU, 2015). As such, assessment of creative problem-solving at MCU focused less on the creative personality of an individual and more on the creativity of the products that students completed (Amabile, 1982; MCU, 2015).

Thus, the problem of practice of this dissertation is not how to instill creativity into students, but how to help their creative capacities grow. The focus of evaluation is on how students display creative problem solving in their written products. Additionally, the present research examined how authoritarian or hierarchical attitudes in the military might inhibit creativity, while other factors inherent to competitive organizations might inhibit or enhance mid-career graduate student creativity (Bryant & Harrison, 2019).

This dissertation examines creativity from the perspective of the military communities in the U.S. and its allied nations, but the perspective of other fields is also considered. Tarzi (2018) has argued that institutions of professional military education ought to examine how the military profession might learn from educational efforts by those in other professions, like business, engineering and education. For instance, although there are many important differences between the military and business
contexts, there are important parallels between the business world and the competitiveness of national security. Likewise, as a member of the higher education community in the U.S., MCU can learn from the experience of civilian universities in encouraging creativity amongst their students. Moreover, MCU can learn from military institutions across the globe, especially those in allied nations, even though contexts will vary.

Many factors influence creativity at the organizational and individual levels. Figure 1.2 is a logic map that shows relationships between many of the factors discussed below at both the organizational and individual levels. The logic map uses Cabrera and Cabrera’s (2016) rules for systems thinking, including their Plectica software. The rules include distinctions, which are annotated by boxes delineating one concept from another, and systems, which are boxes inside of boxes showing the part-whole relationship between concepts (Cabrera & Cabrera, 2016). Additionally, their framework uses arrows to delineate relationships between concepts as well as eyes and points to represent perspectives from one concept to another (points of view). In Figure 1.2, key concepts that will be the focus of chapter 2 of this dissertation are highlighted in yellow. A detailed conceptual framework focused on these key concepts will be discussed in chapter 2. For the purposes of this chapter, these factors are organized for discussion in accordance with Bronfenbrenner’s (1994) ecological systems theory.

**Theoretical Framework**

This study uses Bronfenbrenner’s (1994) ecological systems theory to organize the factors related to creativity in the professional military education context. Though Amabile and Pratt’s (2016) framework has only two levels, the level of the organization
Figure 1.2 Logic map of factors related to creativity at MCU
and the individual, Bronfenbrenner’s (1994) theory provides much greater detail at the organizational level; in that the organizational level has multiple layers and interactions between layers. This is appropriate because students at MCU are members of various and overlapping organizations and groups. For example, they are students at MCU and they are members of the Marine Corps or other services. Additionally, Bronfenbrenner’s (1994) theory adds the element of time, which is not present in Amabile and Pratt’s (2016) model and is an important factor for this context.

**Chronosystem**

For this study, the change in creativity over time as well as the time for creative thinking at MCU lies in the chronosystem (Bronfenbrenner, 1994). Creativity changes over time, both at the level of the individual’s military career as well as the academic year. Marine Corps officer rank progresses from career-level (Second Lieutenant-Captain) to Field Grade-level (Major-Colonel) to General Officer-level (Brigadier General-General). In preparation for this rank progression, officer professional military education in the Marine Corps progresses from early career-level (Expeditionary Warfare School) to intermediate-level (CSC) to top-level (Marine Corps War College). Each of the schools—or equivalent schools from other military services—is required for officers to be promoted to the next rank. The Marine Corps War College is offered only in residence. Expeditionary Warfare School and CSC are both offered via distance or resident. Each of these schools is a part of MCU, while only the resident CSC and Marine Corps War College offer degrees. MCU also offers an optional, highly selective, resident advanced intermediate-level degree program called School of Advanced Warfighting. See Figure 1.3.
CSC students are military officers or civilian employees of the federal government who are generally at the middle of their respective careers. Marine Corps officers make up approximately half of the student body. These students have attained the rank of Major and usually have around ten years of Marine Corps officer experience. These officers can be considered mid-career because twenty years of service is the normal minimum requirement for military retirement. Additionally, because the students are Majors, they are entering a new stage of responsibility and authority as field grade officers. Officers at CSC who come from other countries and other services (e.g., U.S. Army) have similar rank and experience.

Military Creativity from the Start of a Career

Creativity is not always rewarded throughout a military career (Jackson et al., 2019). For example, Bryant and Harrison (2019) argue that the U.S. military has not
placed enough emphasis on developing creative thinking amongst its officer corps and theorize that the military talent management system rewards obedience over creativity and divergent thinking. Moreover, they argue that cognitive diversity (a requirement for creative teams) is low in the military. Mitchell and Cahill (2005) provide one possible explanation for the claim that there is a low level of creativity in the military. They conducted an analysis of the continuation rates for U.S. Naval Academy cadets, finding that U.S. Naval Academy cadets who scored as innovators on a personality test were significantly less likely to make it through the first summer of training at the Academy. Moreover, Mitchell and Cahill found that incoming Naval Academy students were significantly less innovative on the Kirton Adaption-Innovation Inventory than their peers at civilian institutions that were similar in selectivity to the U.S. Naval Academy. Along the same lines, Duckworth (2017), in an analysis involving entering students at the U.S. Military Academy, found that the most important factor for success was grit, not talent. Similarly, Zacharakis and Van Der Werff (2012) argue that entry-level Marine and other service officers are not expected to think critically or solve complex, strategic problems, so these skills only become a focus of training and education at the intermediate level. Parenteu (2021) argues, on the other hand, that the service academies ought to view their role as preparing officers for a full career and not merely preparing them to be junior officers.

**Creativity throughout a Military Career**

At the other end of the career spectrum, Jackson and colleagues (2020), in examining the talent development processes of each U.S. military service, found that, amongst U.S. military services, Marine Corps Generals had the highest level of risk
aversion, that is, aversion to change and fear of failure. Yet this attitude can be a barrier to innovation (Aylesworth & Cleary, 2019). Moreover, they found that the Marine Corps culture and promotion boards rewarded physical fitness, obedience and low-level thinking (tactical) above high-level (strategic) thinking. Likewise, Bryant and Urben (2017) found that the U.S. Army did a poor job of developing strategic thinkers, that officers generally rated their supervisors low on innovation, and that junior officers had few opportunities to think creativity. Meanwhile, Wong and Gerras (2013) argued that senior-level leaders in the Army were less open to ideas and less willing to change their minds than leaders in the general population.

The above evidence indicates that the U.S. military, and specifically the U.S. Marine Corps, does not select for or foster creativity within its officer ranks. However, other studies paint a different picture. For instance, a study conducted in Norway found that senior officers scored higher than lower ranking officers on measures of transformational leadership, which includes the ability to create a climate for innovation (Eid et al., 2004). Additionally, Zaccaro and colleagues (2015) found that U.S. Army officers who had key developmental experiences showed significantly higher levels of divergent thinking skills and that these experiences and divergent thinking skills were significantly and positively correlated to retention in the U.S. Army. Similarly, Clark (2008) found that, for U.S. military field grade officers, higher levels of civilian education correlated with higher scores on creativity tests, indicating once more that key developmental experiences mediate the relationship between creativity and success in the military.
The evidence concerning whether or not the military education system and lifestyle promote creativity is also mixed. Park (2016) argued that the U.S. Army’s intermediate-level school was not rigorous enough when it came to critical and creative thinking and that performance at the school had too little effect on an officer’s later promotion prospects. Similarly, Lianez and Zamarripa (2003) found that completion of mid-career resident graduate education had little effect on officers’ later performance (as measured by graduates’ and non-graduates’ performance evaluations). Moreover, Samosorn (2021) studied the U.S. Army War College and found that faculty believed creativity was not evaluated or rewarded in assessment of professional military education effectiveness.

On the other hand, another study, conducted amongst Norwegian military officers, suggested that culture in a military organization with high degrees of loyalty might contribute to creativity as well as retention (Kirkhaug, 2009). Finally, although Australian military culture, like that of Norway, might be different than the U.S. military’s culture, Sandwith and colleagues (2017) found that Australian military officers became more flexible as they remained in the military longer. Additionally, the researchers found that personal need for structure moderated the relationship between individual creativity and personal need for structure on an evaluation of product creativity, such that high structured tasks yielded more creative results.

**Time Constraints**

Although MCU is a military organization, CSC is also an academic program with students who spend ten months in residence, earning between 38 and 41 credits (MCU, 2021b). This relatively heavy course load raises concern that students at MCU might not
have enough time in any given week to think creatively (Johnson-Freese & Kelley, 2017). Surveys of students and faculty in other institutions have indicated that one of the biggest barriers to thinking creatively in and about higher education curriculum is a lack of time (Alencar & Fleith, 2010, 2014; Potter, 2013). Moreover, Mumford and Gustafson (2007) argue that innovators need time to “incubate” their ideas “following a period of rest” (p. 56).

Additionally, some neuroscience research indicates a correlation between creativity and increased gray matter and brain connectivity associated with incubation of ideas through daydreaming and idea generation (Beaty et al., 2016; Kuhn et al., 2013). Moreover, Immordino-Yang and colleagues (2012) argue that time for rest and daydreaming gives students the opportunity for constructive internal reflection, which has educational benefits that include increased creativity. Similarly, Fink and colleagues (2007) theorize that alpha synchronization in the prefrontal cortex during creative thinking tasks might indicate that creativity requires inhibition of external input in order to focus internally. Hao and colleagues (2016) connect this alpha synchronization with reflection, internal attention, and idea generation. Unfortunately, the heavy course load at MCU suggests that students might not have enough time for the incubation of their ideas through internal focus, reflection, or daydreaming.

Progress in developing soft-skills in the liberal arts, like creativity, can sometimes be slow (King, et al., 2022). As a result, there is a danger that one year of study is not enough time to observe significant changes in creativity level. Several studies have looked at changes in creativity over time within undergraduate professional education contexts (Bandyopadhyay & Szostek, 2019; Gill & Ritzhaupt, 2013; Grant & Smith,
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2018; Perry et al., 2014; Reid & Anderson, 2012). Some studies have struggled to find an effect across multiple years (Bandyopadhyay & Szostek, 2019; Gill & Ritzhaupt, 2013; Perry et al., 2014), but other studies found significant improvements in critical and creative thinking over courses as short as four weeks to one semester (Carson, 2015; Gao & Quitadamo, 2015; Grant & Smith, 2018; Reid & Anderson, 2012). At the extreme end of the scale, one study at U.S. Army Command and General Staff College found significant gains in creative thinking after only one class session that incorporated narrative exercises like plot twisting (McConnell et al., 2023). Within a Russian military context, Volynkina and colleagues (2020) found significant improvements in creative thought over the course of a Russian military school for foreign languages. Though the Russian context is likely different in important ways from the U.S. military context, MCU has also found improvements over one year in critical and creative thinking (Bishop, 2020; Jensen, 2018a; 2019; MCU, 2021a).

Time is a major resource required for creative thinking but, at the same time, time constraints can sometimes improve creative results (Amabile, 1998). Marines, and military officers in general, are expected to make decisions and solve problems in a time-constrained, uncertain environment with access only to incomplete information (USMC, 2020a). This environment is one of competition where the speed of decision-making is often more important than the actual decision that is made (USMC, 1997a). In one famous anecdote from 1995 shared by Franke (2011), the first President of MCU had Marines face off against New York Mercantile Exchange stock traders in a simulated stock trading environment and in a simulated wargame. Of course, the stock traders beat the Marines in the stock trading game, but they also surprisingly beat the Marines in the
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wargame. Apparently, the stock traders were much better at making decisions quickly under conditions of uncertainty and at recognizing, and acting on, emerging patterns (Franke, 2011). Since that time, many things about a Marine’s education have changed. For instance, to prepare for an environment of high uncertainty and limited time, Marine education has focused on developing knowledge and habits of mind in peacetime that will help Marines to solve problems both creatively and quickly (USMC, 2020b).

To some extent, preparing for this time-pressured environment requires time-pressure in assessment, but time-pressures should not necessarily be applied to all military training and education events. Although most creativity studies included in this review did not consider time-constraints, one study of critical thinking ability in a business school context used time-pressured assessments to measure problem solving ability (Bandyopadhyaya & Szostek, 2019). Unfortunately, the study found very little improvement over a multi-year period (Bandyopadhyaya & Szostek, 2019), which might suggest that time-pressure in assessments made it so that students could not display their enhanced critical thinking skills.

On the other hand, Kitchell (1995) found many complaints about high pressure and overwork at innovative companies, but observed lower pressure and more time to talk in non-innovative companies. Kitchell also observed that employees at the innovative companies were happy about their autonomy and opportunities for personal growth. This finding reinforces Amabile’s (1998) argument that time constraints enhance creativity when they are coupled with intrinsic motivation. Although these studies were conducted in business contexts, the aforementioned similarities between business and military environments suggest that findings from these studies might transfer to Marine Corps
contexts and that students at MCU need a mixture of time-pressured and lower pressure events in order to enhance their creative problem-solving ability.

**Macrosystem**

The macrosystem is the level at which MCU interacts with other exosystems (Bronfenbrenner, 1994). At the macrosystem-level, MCU exists within the United States Marine Corps and Department of Defense, but also within the system of higher education in the United States. Moreover, many students are part of other U.S. military services, other governmental agencies, and even other national governments. Within one classroom, students from multiple military services, other governmental agencies and even multiple countries interact. Each specific military culture varies and the U.S. Marine Corps has its own unique culture (Chiu & Tu, 2014; Jackson et al., 2019). This study will focus primarily on the uniqueness of military culture in general and the Marine Corps culture specifically.

**Diversity**

There is a strong and growing consensus that diversity of thought is required in order to achieve the best solutions to the most complex problems, and that diversity of identity contributes to diversity of thought (Scott, 2017). MCU has made progress primarily with respect to the gender diversity of its faculty, but in 2023 only about 12% of its degree program faculty were women and only five of its deans, academic program directors, and executives were women (MCU, 2023). As with the Marine Corps especially, and the military in general, MCU’s student body also has a long way to go to achieve gender and racial equity. For instance, in academic year 2023, only about 13% of CSC students were women (MCU, 2023). Although MCU does not publish race and
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ethnicity information about its students, a general idea can be estimated from the fiscal year 2023 intermediate level education board for the Marine Corps. On this board, which selects mid-career officers for residential educational opportunities, including but not limited to CSC, only about 14% were students of color (U.S. Marine Corps, 2019; 2023).

Still, MCU’s student body does benefit from the diversity of thought that comes with its inter-service, international and federal civilian students, who compose about 50% of the student body of the degree granting programs (MCU, 2023). Even so, students might benefit from a much wider spectrum of perspectives, including those of students who have not spent their entire professional lives working for the federal government (Fleischaker, 2021; Wong & Gerras, 2013). For instance, in one study in which military officers were interviewed about their key developmental experiences, they frequently cited experiences outside of the Department of Defense, including at civilian schools, where they were exposed to different ways of thinking (Salmoni et al., 2010).

Although the military needs a culture that values diversity and a teaching methodology that encourages difference, it has a long history of valuing uniformity over diversity (Eriksen, 2015; Lim & Renshaw, 2001; McLaurin, 2009; Schogol, 2020). As Hill (2015) puts it, “At the extreme, the ideal combatant, whether a commander or a subordinate, is replicable across the entire organization” (p. 92-93). In coordination with this preference for uniformity, some military scholars worry that continuous attendance at professional military schools might perpetuate group-think and subconscious conformity amongst military officers (Bryant & Urben, 2017; Jackson et al., 2019; Johnson-Freese & Kelley, 2017).
On the other hand, some question whether diversity might inhibit creativity (Corritore et al., 2019; Piwek, 2015) or have no effect (Matić, 2019; Wang et al., 2013). For instance, Piwek (2015) argues that in military planning, diversity of thought might generate more radical ideas, but this same diversity makes putting those ideas into practice more difficult. In business contexts, Corritore and colleagues (2017) found that interpersonal diversity was associated with lower efficiency, but that divergent thinking in individuals was positively associated with higher patent volume.

While acknowledging that efficiency problems related to communicating across differences exist, Page (2017) argues that good leaders manage communication difficulties to enable diversity’s creative potential and overcome its hurdles. Within the Lithuanian military context, Smaliukienė and Survilas (2018) found that team communication was the strongest predictor of organizational creativity. Metacognition, which includes both the capacity to evaluate our current knowledge and the capacity to strategize ways of improving it, is a key strategy for enhancing cross cultural trust and communication leading to greater creativity (Chua et al, 2012; Flavell, 1979; Ku & Ho, 2010). Furthermore, Khachadoorian and colleagues (2020) describe how incorporating metacognition into military education has helped to increase students’ ability to creatively collaborate with their interservice, intergovernmental and international colleagues.

**Culture for Innovation**

An organizational culture of support for innovation is key to building individual and team creativity and to putting that creativity into practice (Amabile, 1998; Amabile & Pratt, 2016). For instance, in the business context, several studies have established a link
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between organizational culture and innovation (Dodge et al., 2017; Kitchell, 1995). Dodge and colleagues (2017) found that the following three dimensions emerged in employees’ perceptions of their organizations’ behaviors: “providing organizational encouragement, ensuring challenging work, and fostering support within the work group” (p. 25). Moreover, Kitchell (1995) found that innovation is associated with a flexible culture and that innovative companies attempted to change with the environment (including extending their business into the international market) while non-innovative companies saw their competitors (especially foreign) as having an unfair advantage and attempted to maintain the status quo.

Within a military context, the research concerning support for innovation reflects a wide diversity of cultural paradigms within the military itself. At the service level, Hill (2015) argues that the Army and Marine Corps are more innovative than the Air Force and Navy because of the latter’s strict technical requirements, but Chiu and colleagues (2014) found that Taiwanese military cadets primed to write about an imagined career in the Air Force scored higher on an assessment of creativity than those primed to write about an imagined career in the Army. Other sources argue variously that the U.S. Army, Navy and Marine Corps have especially risk-averse or inflexible cultures (Eriksen, 2015; Jackson et al., 2019; Wong & Gerras, 2013). Importantly, Whittinghill and colleagues (2015), while speculating that the military culture is generally more hierarchical and mechanistic than organic, found a positive and significant relationship between respondents’ perceptions of the climate for innovation at their organization and the degree to which they perceived their organizational culture to be flexible and adaptive.
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There is an unfortunate tension between the requirement for flexibility and adaptiveness in the operational environment and the hierarchical culture of the military (Hill, 2015). For instance, Kalyaap (2018) argued from a Turkish military context that military culture is highly structured and inflexible, but found that transformative leadership and innovative climate was significantly and positively correlated to subordinate personnel creativity. Similarly, a study involving a U.S. Navy aircraft carrier’s crew found that specific strategies enacted by the carrier’s leadership helped to circumvent the hierarchical barriers to creative ideation and communication amongst the crew (Eriksen, 2015).

Two interesting studies within the U.S. Army context further illustrate the relationship between Army culture and the acknowledged requirement that the U.S. military needs to be more creative and innovative. Wong and Gerras (2013) found that battalion commanders had lower levels of openness than the general population, even though openness is needed at that level of command. Moreover, only about half of Army leaders reported that their units encouraged the free flow of ideas, which Wong and Gerras (2013) attribute to a culture that inhibits subordinates from expressing divergent opinions or questioning directives. On the other hand, another study gives reason for a deeper look at the specific context. Hill (2015) delineates three main factors that determine whether or not an innovation is adapted in a military context: honor (or morality), ability to control, and regularity. Although Hill (2015) finds general support for the idea that military culture inhibits innovation, he points out that a blanket generalization obscures the fact that some aspects of military culture might be good for innovation and that there are important differences between military organizations. For
instance, deference to authority might be a problem that inhibits divergent thinking, but it is also a strength in implementing creative ideas when an authority figure determines that an innovative idea must be adopted (Hill, 2015).

Exosystem

The exosystem at MCU is the university itself, which incorporates the interactions between and amongst the colleges as well as the University leadership and staff (Bronfenbrenner, 1994). A major way in which the University exosystem influences this problem of practice is the University’s assessment strategy. CSC, the focus of this problem of practice, does not have its own assessment experts, so assessment decisions are made at the University administrative faculty-level. Support for assessment plans can be mixed amongst teaching faculty. An additional factor related to the exosystem at MCU is the creation of a Center for creativity and innovation as part of MCU’s Quality Enhancement Plan (Bishop, 2020; MCU, 2015; MCU, 2021a). The Center conducts co-curricular events and hosts academic scholars who have expertise in areas not otherwise present in the teaching faculty.

Assessment Strategies

In accordance with the requirements for accreditation with the Southern Association of Schools and Colleges Commission on Colleges, MCU developed a quality enhancement plan entitled “Strengthening Leadership through Enhanced Creative Problem Solving” (MCU, 2015). The process of developing this plan involved a team of faculty and staff members, led by the then-Chair of the Faculty Council, who was an associate professor at CSC and is now the Provost/Vice President for Academic Affairs (MCU, 2015). This planning team settled on creative problem-solving as the student
outcome of interest and decided to use Amabile’s (1983) consensual assessment technique as the means of assessing progress, with the goal that 80 percent of the student body would achieve the level of creative or transformative on a modified creativity rubric from the Association of American Colleges and Universities (AAC&U, 2009; MCU, 2015).

The consensual assessment technique places emphasis on the opinion of experts in a field as to the creativity of a product, not just an idea (Amabile, 1983). It has been used in multiple studies of the creativity of student artifacts in both military and civilian contexts (Matić, 2019; McClary, 2009; Sandwith et al., 2017; Vincent et al., 2002). In one of the studies, the researcher did not find significant differences in the relationships between the independent variables and the dependent variable, as measured by the consensual assessment technique (Matić, 2019). On the other hand, McClary (2009) used the consensual assessment technique to evaluate military student planning exercises and found that the greatest factor in differentiating scores was the classroom environment, not the characteristics of the individual student.

At MCU, initial efforts to use the consensual assessment technique were spottily reported and the University encountered differences in the interpretation of the rubric, which resulted in the decision to conduct norming even though this is not a normal feature of the use of the consensual assessment technique (Amabile, 1983; MCU, 2021a). Ultimately, MCU did not meet its 80 percent creative or transformative goal in any year of assessment and variations in results between years were often the result of inconsistencies in the application of the assessment as well as changes to the prompt for the artifacts assessed (MCU, 2021a). Still, in each year assessed, there was some
evidence of improvements in creative problem-solving from the fall baseline assessment to the final assessment in the spring (MCU, 2021a).

**The Center for Applied Creativity**

Another major aspect of MCU’s quality enhancement plan was the creation of a center for applied creativity (MCU, 2015). Initially tasked with oversight of the quality enhancement plan and with developing or implementing various interventions related to that plan, the Center’s mission and name changed multiple times over the course of the assessment period (Bishop, 2021; MCU, 2021a). Ultimately, the center, now known as the Krulak Center, has become more of a think tank and a home for cross-university collaboration and inter-college competition related to the topic of innovation and future war (Bishop, 2021).

Studies indicate that co-curricular learning may be just as important, or more important, than classroom learning for developing real-world competencies (Benjamin & Hamrick, 2011; Blake Jones, 2011). The Krulak Center has become the chief co-curricular organization at MCU and its focus rests squarely on real world and future contexts. Additionally, the Krulak Center hosts resident and non-resident scholars who provide subject matter expertise in important regional and policy areas related to military education. In addition to research, these scholars give lectures, teach electives, and serve on thesis committees at CSC.

**Mesosystem**

The mesosystem involves interactions between the various microsystems within which the students find themselves (Bronfenbrenner, 1994; Neal & Neal, 2013). At CSC, students are divided into conference groups—like seminar groups—of 12-14 students that
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persist throughout the year. Although there are large lectures involving the whole college, and even occasionally university-wide lectures, the conference group is the main place where students engage in structured discussions about the curriculum. Each conference group is led by one civilian Ph.D. faculty member and one military officer senior in rank to the students. Faculty move across conference groups for certain subjects and conference groups do occasionally combine with one another, usually in planning exercises associated with wargaming events and competitions.

Transdisciplinarity

For the students, the curriculum at CSC is transdisciplinary. Students study subjects in a diverse range of topics within the social sciences and humanities (MCU, 2021b). Studying a range of topics can benefit a person’s creativity (Brown, et al., 2014; Epstein, 2019). On the other hand, the opportunity to study with faculty at a deeper level in areas like science, technology, engineering and mathematics is very limited due to the fact that few faculty members have expertise in these areas (MCU, 2021b). Often, a faculty member will need to lead discussions involving topics outside of their area of academic study and will be expected to integrate their own subject matter expertise into the general curriculum.

Competition

Andrew Hill (2015), Professor of Organizational Studies at the US Army War College, argues that the solution to bureaucratic barriers to creativity in the military is competition. Specifically, wargaming new ideas in competition with older ideas is crucial in the military context to identifying problems and potential solutions (Hill, 2015). A great example of this concept was Millenium Challenge 2002, a major Department of
Defense wargame in which the supposedly weaker opposing force decimated the U.S. military team, leading to adaptations in U.S. military tactics (Zenko, 2015). Given the importance of competition for military innovation, wargaming is a major new priority for the U.S. Marine Corps and the Department of Defense (Berger, 2019; JCS, 2020). At MCU, in addition to the wargaming conducted at the Krulak Center, the colleges also use wargaming to teach tactics, planning, and strategy and to foster student creativity (Jensen, 2018a; 2019; Lacey, 2016). Wargames are conducted within seminar groups, between seminar groups, and university-wide (Gordon et al., 2020; Lacey, 2016; Jensen, 2018a; 2019).

Professional identities in Graduate School

Military students have a unique identity with multiple, diverse professional community memberships. For instance, U.S. Army students are evaluated by their Marine Corps faculty, but also by the senior U.S. Army officer on the faculty at MCU. A similar process occurs for members of the U.S. Air Force and U.S. Navy. Thus, students from other U.S. services need to maintain contact with faculty other than those of their conference group. Additionally, students bring their professional job specialty to the conference group and are expected to represent that specialty during practical exercises like wargames. These specialties are, broadly speaking, combat arms (e.g. infantry, armor), combat service support (e.g. supply, logistics), and aviation.

Additionally, military students sometimes find it challenging to make the transition from the military, and specifically from their unique niche community in the military, to an academic context (Hargrave et al., 2016). One study found that military students’ pride in their job accomplishments might interfere with their willingness to
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adapt to an academic program and that military members might struggle to feel that they belong in an academic environment (Hargraves et al., 2016). Similar findings have been reported for other adult students returning to the classroom, who face challenges connecting to faculty and peers and reconceptualizing themselves as students (Reiff & Ballin, 2016). This struggle can be exacerbated by post-traumatic stress, which is relatively common in combat veterans (Ferrajão, 2017; Ness et al., 2015). For instance, one study involving graduate students on active duty examined the perceived effect of PTSD on learning amongst female students at the US Army’s Command and General Staff College, finding that some students who had experienced combat-related trauma reported difficulties in retaining information and paying attention in class (Berg & Rousseau, 2018). These factors might prove to be barriers to creative problem-solving in professional military education contexts.

Family

Another microsystem interacting within this mesosystem is the students’ families. Family stressors related to frequent military moves include spousal unemployment and underemployment, especially for spouses with advanced degrees (DeLomba et al., 2021; Friedman, et al., 2015). Because MCU is one year long, students often relocate to Quantico with their families for one year and then relocate to another location for their follow-on assignment. Other families decide that in order to maintain continuity for a partners’ job or children’s schools, partners and children will not re-locate to Quantico for the year of CSC. Thus, some students live alone for the academic year. How this decision interacts with the curriculum of CSC to inhibit or enhance creativity is a question for further study. Though Sandwith and colleagues (2017) found that these
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Frequent lifestyle changes might help to develop flexibility and thus creativity in military personnel; they also present sizable stressors for military learners, which might be detrimental to their learning (Hardiman, 2012). For both professional identities and family considerations, faculty and staff can create a sense of belonging for military students and their families, but such a sense of belonging depends upon faculty and staff willingness to demonstrate concern for students’ unique circumstances (Cheng, 2005).

Microsystem

The microsystem is the immediate local setting of the students (Bronfenbrenner, 1994), which in this case is primarily the conference group of 12-14 students and 2 faculty members. The conference group is the primary and enduring structure of a residential MCU student’s experience. All class discussions about all subjects occur in this group. Most class projects and team assignments also occur within this group.

Leadership

Numerous studies examine the impact of transformational leaders on creativity (Eid et al., 2004; Kayaalp, 2018, Wang et al., 2013). According to Bass & Riggio (2006) transformational leaders inspire followers to achieve superior results and to develop into transformational leaders themselves. One aspect of transformational leadership is the leader’s ability to encourage subordinates to creatively solve problems by providing them with an environment that supports their creativity (Bass & Riggio, 2006).

Transformational leadership is one way of thinking about a military officer’s leadership role. Transformational leaders inspire followers to, amongst other things, be creative and innovative (Bass & Riggio, 2006). One study of special interest, conducted amongst Norwegian officers, examined how transformational leadership is related to
operational success during a major military exercise, finding that transformational leadership was significantly and positively correlated to operational readiness (Eid et al., 2004). Within the military education system of the U.S. Army, another study used peer evaluations of creativity and found that creativity explained 68% of the variance in measures for leading change amongst intermediate-level officers (Matthew, 2009). These studies indicate that the interaction between faculty leaders and military students is an important factor in encouraging or limiting student creativity as well as modeling what it means to be a leader who fosters creativity and innovation.

A number of studies have considered how leaders in the military can stifle creativity or encourage it in their units (Eriksen, 2015; Matthew, 2009; Eid et al., 2004; Kayaalp, 2018; Piwek, 2015). Along these lines, military officers on the faculty at MCU have great influence over the atmosphere for creativity in a conference group. They are academic advisors and instructors, but they are also—perhaps primarily—leaders. Their main qualification is their operational experience in leadership positions senior to what the students have experienced. By virtue of their rank and their responsibility to write professional evaluations—distinct from grades—for all the students, they are the definitive leaders of the conference groups.

Another factor in the military classroom is the differentiation and prominence of rank and seniority between students and faculty as well as amongst the students. In a Korean business context, Park and colleagues (2018) found that creativity was significantly and positively correlated with team with a high breadth of expertise, but that differences in organizational tenure were a significant negative moderating factor in the relationship. Another business study, conducted in China, found that perceived insider
status was correlated with creativity and even moderated the negative effect of supervisor incivility (Liu et al., 2019). Similarly, the wearing of uniforms in class at MCU highlights differences in insider status between Marine and other students. These findings suggest that indicators of seniority and service, like those that appear on military uniforms, might not be conducive to creative problem-solving.

Curriculum and Instruction

Many curricular innovations in both civilian and military educational contexts have been described in the literature. For instance, one study involving graduate business students found that students appreciated journaling as a tool for building creativity, though the study was unable to differentiate between journaling and other interventions in the growth of student creativity (Dewett & Gruys, 2007). Similarly, McConnell and colleagues (2023) found that narrative exercises like plot twisting also helped to improve student creativity at U. S. Army Command and General Staff College. Another study hypothesized that an individual student’s tolerance for ambiguity would be significantly related to the creativity of their military planning artifacts, but found instead that the most important factor was the instructors’ mindset for creativity versus convention (McClary, 2009).

Some studies suggest that putting students in greater control of their learning environment encourages creativity. For instance, Gao and Quitadamo (2015) found that undergraduate biology students showed greater levels of critical and creative thinking when they engaged in term-length projects that they had selected themselves. Another study found that, in an undergraduate business capstone course, the creativity of student responses to case studies was significantly and positive related to course structures that
involved case studies, group work, and some student control over the content of the course (Gill & Ritzhaupt, 2013). Another business capstone course used pedagogical strategies aimed at increasing student motivation, critical thinking, practice, and metacognition and found that students made significant critical thinking gains (Reid & Anderson, 2012).

Within a Russian military context, curricular innovations focusing on problem-solving and historical case studies as well as developing student motivation and an attitude of continuous self-improvement enhanced student creativity scores (Volynkina et al, 2020). Additionally, in their discussion of their findings, Volynkina and colleagues (2020) claimed that learning a foreign language was an important factor in developing creativity. At MCU and other U.S. military education contexts, a few academic interventions similar to those listed above and related to multicultural education, metacognition, case study methodology, and critical thinking have been developed (Furtado, 2017; Jensen, 2018a; 2019; Khachadoorian et al., 2020). On the other hand, there is often little flexibility in a military faculty member’s ability to modify the curriculum and in a military students’ ability to choose what to study, even though these interventions have proven effective in other contexts.

**Individual**

At the individual level, one major consideration is the creative thinking ability that the students have and how this creative thinking ability interacts with ingrained attitudes toward authority. Another consideration is the students’ entering level of knowledge in areas of the curriculum not directly related to military tasks (e.g. social scientific method, international relations). Amabile’s (1988; Amabile & Pratt, 2016)
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componential model of creativity, with its three components of individual creativity, serves as the main conceptual framework for this section. The three components are motivation, creativity skills like divergent thinking and metacognition, and knowledge and skills in the domain of the activity (Amabile, 1988; Amabile & Pratt, 2016).

**Personality and Mindset**

Though not the focus of MCU’s efforts, personality-related factors can play a role in the creativity of a student’s products. For instance, Batey and colleagues (2010) found that ideational behavior was significantly positively correlated with openness to experience, fluid intelligence, and gender while agreeableness, IQ, and conscientiousness were significantly negatively correlated with ideational behavior. Another study, involving enlisted senior members of the Air Force, found that military members were more likely to be adaptive than innovative and that innovative styles of creativity were correlated to extroversion on a personality test (Johnson, 2003).

Mindset toward creativity is also an important factor. Katz-Buonincontro and colleagues (2017), in a study focused on engineering students, found that a student’s perception of their own creativity was significantly and positively related to actual creativity, while beliefs that they could not improve on their creativity were significantly and negatively related to creativity. Relatedly, a study involving undergraduate business students found a significant and positive correlation between creativity and self-reported measures of flow and sensory thinking (Schlee & Harich, 2014). Given typical depictions of how personal characteristics of service members limit creativity, it seems that encouraging a growth mindset about the potential for creativity in military personal would be highly preferable to a fixed mindset in which creativity cannot be improved.
Divergent Thinking vs. Authoritarianism

Can creativity thrive within a strictly hierarchical and authoritarian culture like that of the U.S. military? Amabile (1998) describes how the relationship between authority and creativity can work in business: “Creativity thrives when managers let people decide how to climb a mountain; they needn’t, however, let employees choose which one” (p. 81). A similar focus on what the Marine Corps calls “Commander’s Intent” gives subordinates the guidance they need in order to deviate from specific tasks as the situation dictates, while maintaining focus on the larger intent of those tasks (USMC, 1997, p. 89).

Along these same lines, loyalty is a core value of many military organizations, and researchers have found that the loyalty of the service member influences the service member’s creativity level (Kirkhaug, 2009). Interestingly, while one might expect loyalty to be a barrier to creativity, Kirkhaug (2009) found a U-shaped relationship, such that high and low loyalty both correlated with high creativity while moderate loyalty and low creativity were also correlated. This suggests that military loyalty to authority might, in some cases, encourage creativity.

Balancing respect for military authority and critical thinking can be difficult, both for military students and for military faculty. Parenteau (2021) argues for the imperative to teach officer cadets how to think critically and acknowledges power disparities between junior personnel and senior officers that might cause junior personnel to avoid communicating critical or creative thoughts to their commanders. In an attempt to resolve this conflict, Parenteau (2021) suggests the following three rules for critical thinking in the military: never question the authority of those in command, criticize the plan and not
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the planner, and always obey legal orders, even if one disagrees with them. These rules seem reasonable in almost any context, but are probably especially important in a military context.

Some studies found that successful military-related problem-solving was correlated with divergent thinking and similar creativity-related constructs (Eid, et al., 2004; Sandwith et al., 2017; Vincent, Decker & Mumford, 2002; Zaccaro, et al. 2015). On the other hand, Eriksen (2015) found strong biases towards the status quo and hierarchical decision-making in the U.S. Navy. Furthermore, Piwek (2015) found the Marine Corps planning process to be unsuitable for more complex problems while Furtado (2017) found the same problem for the U.S. Army’s military decision-making process. Whether or not structural authoritarianism serves as a barrier to creativity in the conference groups at MCU is a major focus of the needs assessment in chapter two of this dissertation.

Motivation

Intrinsic motivation is one major factor that positively influences creativity in Amabile’s model of creativity (1988; Amabile & Pratt, 2016). Extrinsic motivation, on the other hand, can have a negative influence on creativity unless it aligns correctly with existing intrinsic motivation (Amabile, 1998; Amabile & Pratt, 2016). Amabile (1988) defines intrinsic motivation as the individual’s inclination or liking for the task, while extrinsic motivation consists of the external considerations, not essential to the task itself, that control or constrain an individual’s actions. Certainly, military officers are commonly known for their general motivation (Bryant & Harrison, 2019), but are they intrinsically motivated to create within the subject matter of CSC?
Unlike application processes at most other graduate schools, Marines do not apply for CSC; rather, they are selected by a board from amongst an eligible population (USMC, 2019). Although potential selectees can indicate their preferences, this board selects Marines for multiple mid-career academic and professional development opportunities based primarily on professional performance, rather than academic qualifications (USMC, 2019). As a result, the potential exists for Marines to be selected to attend CSC in spite of the fact that some do not want to attend CSC. Furthermore, current Marine Corps promotion board practice places relatively little weight on academic performance at CSC and does not distinguish between resident degree completion and completion of a non-degree distance program (Jackson et al., 2020). In fact, until the 2020-2021 academic year, resident CSC students were given the option to choose not to enroll in the degree program, which effectively meant that students did not have to produce a thesis, and around 15 percent of students annually chose not to complete the degree (MCU, 2021c; USMC, 2020c).

Within the wider military community, there is concern that military officers need extrinsic motivation to creatively explore alternative solutions or to excel academically (Bryant & Harrison, 2019; Jackson et al., 2020). At the highest levels of authority, the joint professional military education system, which encompasses Department of Defense intermediate and senior level profession military education institutions, places emphasis on student learning outcomes related to creative problem-solving, and numerous high-ranking officers have issued guidance outlining the importance of creativity (Berger, 2019; Chairman of the Joint Chiefs of Staff, 2020; Department of Defense, 2018;
Department of the Navy, 2020; Joint Chiefs of Staff, 2020). This emphasis on improving military officer creativity provides a certain level of extrinsic motivation.

On the other hand, some studies indicate that lower-level, everyday practice in the military can diminish motivation for creativity (Bryant & Urben, 2017; Eriksen, 2015). For instance, one study looked at how Navy leaders on one aircraft carrier overcame conservatism and inertia to encourage junior sailors to present innovative ideas to their chain of command, but the researcher ultimately concluded that this particular case was unique and that, generally, the Navy resists change, especially from lower ranking Sailors (Eriksen, 2015). Moreover, in a study conducted at the US Army’s Command and General Staff College, the researcher gave relatively low marks to the intermediate-level educational program on the degree to which extrinsic motivation (e.g. grades) influences student creativity (Hitt, 2016).

Knowledge and Skills in the Task Domain

One key component of creativity is knowledge or skill in the domain of the task (Amabile, 1988; Amabile & Pratt, 2016; Brown et al., 2014; Leslie, 2014; Mumford & Gustafson, 2007). Learners need to be able to recall prior knowledge in order to use it to solve problems, (Brown et al., 2014), and having prior knowledge helps creative inquirers to ask the right questions (Leslie, 2014). Moreover, knowledge and skills in the task domain, including technical skills, provide problem solvers the materials needed to think creatively (Amabile, 1988). Knowledge is also crucial to the ability to create useful models, which are important for solving complex problems (Brown et al., 2014; Mumford & Gustafson, 2007). Outside the military context, some studies have shown that non-science majors often do not possess a good understanding of the scientific
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process (Beck-Winchatz & Parra, 2013; Schlee & Harich, 2014). Moreover, Schlee and Harich (2014) found that business students with quantitative majors performed better than those with non-quantitative majors on a test of creativity.

Of course, mid-career military officers possess solid knowledge of military planning and tactics before arriving at CSC, but some studies have shown that they might lack knowledge of other portions of the curriculum, like strategy or social science methodology (Bryant & Urben, 2017; Fosher, 2015; Fosher, 2018; Hill, 2015; Holmes-Eber, 2012; Jackson et al., 2019, Perez, 2016). For instance, Wong & Gerras (2013) argue that U.S. Army Generals prefer to make decisions based on intuition instead of empirical data, while Hill (2015) points out that advances in data collection and methodology have outpaced military education concerning how to use data. Meanwhile, Tingle (2021) points out that China’s military education system is heavily STEM-focused, while very few U.S. Army Generals have degrees in STEM, at any level. As a result, Tingle argues that U.S. Army Generals are at a disadvantage when trying to creatively solve problems presented by emerging technologies or to develop technological solutions to those problems. Additionally, in the Marine Corps context, officers with aptitude for science and mathematics are more likely to be assigned to the Naval Postgraduate School than MCU (Lianez & Zamarripa, 2003; USMC, 2019). This practice decreases the opportunity for officers at MCU to learn from peers with experience and knowledge of science and scientific methodology. Thus, one major factor contributing to a lack of creative problem-solving ability in military officers at MCU might be insufficient knowledge and skills in the task domain.
Metacognition

Research suggests that metacognition is an effective strategy for building critical and creative thinking skills (Bruning et al., 2011; Chua et al., 2012; Ku & Ho, 2010). Flavell (1979) introduced the idea of metacognition with focus on how children learn, but also theorized that the same general processes are involved in adult learning. In general, metacognition refers to two basic capacities—the capacity to evaluate our current knowledge and the capacity to strategize ways of improving it (Flavell, 1979; Khachadoorian et al., 2020, p. 4; Ku & Ho, 2010). Metacognition appears to have an independent effect on learning, relative to other factors like academic ability, knowledge in the task domain, and intelligence (Schraw & Dennison, 1994). Moreover, Mumford and Gustafson (2007) show that time for reflection is necessary for even experts to avoid unconsciously incorporating prior errors into new designs.

Given the large credit load expectations of some military educational institutions (discussed above), some military educational institutions might have difficulty giving military students an opportunity to reflect on their learning in this way (Johnson-Freese & Kelley 2017). However, at Marine Corps War College, the next senior level of professional military education to CSC at MCU, one faculty member has begun incorporating metacognition into a seminar early in the academic year (Khachadoorian et al., 2020). This one-session seminar lasts for two hours and attempts to help students think about how metacognition might help them make decisions and understand multicultural interactions. Though a relatively minor part of the academic year, the hope is that students will incorporate the metacognitive strategies learned in this seminar to guide their participation in the rest of the seminars throughout the rest of the year. Air
University, another professional military institution, also incorporated metacognitive practices into elective courses and shorter-term professional development seminars for senior leaders (Khachadoorian et al., 2020). There is also some evidence that, in the business world, metacognition about cultural differences helps teams to collaborate to produce creative solutions to business problems in multicultural teams (Chua et al., 2012). If metacognition is, on the other hand, related to creative and diverse teams of mid-career military officers, this would be extremely important information for building the kinds of multicultural teams that the Marine Corps needs.

The above academic innovations are largely short-term interventions. Other, less specific, professional military education related attempts at developing metacognitive capacities focus on general critical thinking (Zacharakis & Van Der Werff, 2012). During the 2020-2021 academic year, as part of a process called MCU 2030, the University gathered input from faculty and staff on what major changes they would like to see MCU enact by 2030. Of the major themes distilled from the comment period, one theme was an increased focus on cognitive and metacognitive competencies (Mackenzie, 2021). As a result, a working group, including the present author, was created to propose a plan to achieve this designed result. Among other things, the proposal called for an experimental seminar group focusing on enhancing student metacognitive abilities.

Conclusion

The Marine Corps specifically, and the U.S. national defense community in general, has identified the need for military personnel to think creatively rather than relying merely on overwhelming military force. As a part of the professional military education community, MCU is tasked with fostering the creativity of its students in order
to build a military culture that promotes and benefits from creative thinking. Above all, creative thinking in the military context focuses on the ability to create products that are both novel and useful. As such, the focus is on creative problem-solving for problems of importance to the national security community. Moreover, as the Marine Corps enters a period of transition in force design and operating concepts, the opportunity to think creatively at MCU may prove crucial to international competition in the 21st century or to U.S. military success in future conflicts. The innovations the emerged during the first half of the 20th century and the role that the Marine Corps Schools played in those innovations serve as examples of how creativity in professional military education is vital to national security interests.

This study draws on research in military and other professional contexts and uses Bronfenbrenner’s (1994) ecological systems theory to organize factors related to creativity in the professional military education ecosystem. Amabile’s (1988; Amabile & Pratt, 2016) model of creativity and innovation inspired the conceptual framework for how these creativity factors related to each other and to the various organizational levels in which MCU students find themselves. Key factors include the climate for innovation, student motivation, divergent thinking, and skills and knowledge in the military and social science domains. Additionally, the relationship between divergent thinking and military authority is an important factor in this particular context.

Ultimately, a military career in some ways both encourages and limits creative thinking. Military culture is generally hierarchical and military organizations can struggle to encourage divergent thinking instead of promoting authoritarianism. At the same time, some military organizations have developed a culture of innovation, and sometimes
authoritarianism can ensure the adoption of creative or divergent ideas. Likewise, somewhat surprisingly, loyalty can play a positive role in creative thinking when service members are invested in the organization and dedicated to its success.

One major focus of CSC is to develop Marine leaders who think creatively and lead innovative organizations. If the College is successful, students will both engage in creative thinking as well as learn how to encourage creative thinking and adopt creative ideas in the organizations they lead. At the level of the individual, metacognition seems to be one important skill and practice that might serve as a keystone for developing other attitudes and beliefs that encourage creativity.

Though many factors are discussed here, the next step of this project is a needs assessment, which will narrow the number of factors examined and attempt to establish which factors are most important to creative problem-solving in this context. The needs assessment will include a secondary analysis of student products as well as surveys focusing on the following factors: motivation, metacognition, divergent thinking, authoritarianism and domain knowledge. These factors, as they are present in new CSC students, are influenced by the wider military culture. At the same time, if students internalize lessons learned at CSC, they might help build a future organizational culture that incrementally becomes more of an impetus to creativity than a barrier. As such, this study might help to build both creativity in individuals and innovation in the wider military organizational culture.
CHAPTER 2: NEEDS ASSESSMENT

This chapter presents the design and results of a needs assessment concerning the creative problem-solving ability of students at MCU’s CSC. The study draws primarily on Amabile’s (1988; Amabile & Pratt, 2016) componential model of creativity in individuals and innovation in organizations. According to Amabile’s model, there are three main factors in creativity in individuals, with three related factors for innovation in organizations. Amabile’s three main factors for individuals are skills and knowledge related to the task, motivation, and creative thinking skills, while factors at the organizational level relate to giving members the opportunity to create and providing them with proper motivation and resources.

Within the category of creative thinking skills, the needs assessment for this study investigates how divergent thinking and metacognition contribute to creative problem-solving. Divergent thinking is the ability to approach problems from alternative perspectives and develop alternative solutions (Furtado, 2017; Mitchel, & Cahill, 2005; Vincent et al., 2002). Metacognition is the ability to evaluate our knowledge and the capacity to strategize ways of improving it (Chua, 2012; Flavell, 1979; Khachadoorian et al., 2020; Ku & Ho, 2010). The needs assessment also considers the possibility that military authoritarianism and hierarchy might serve as a barrier to creative problem-solving. Within the category of skills and knowledge related to the task, the needs assessment focuses primarily on students’ knowledge of the subject matter at CSC. Finally, within the category of motivation and opportunity, this needs assessment considers the motivation of the students as well as the resource of time.
Conceptual Framework

The conceptual framework for this study focuses on seven constructs from the logic model in Figure 1.2. See Figure 2.1 for the hypothesized relationships between these selected constructs. Of particular note, authoritarianism is highlighted in red in this framework because it is hypothesized to have a negative relationship with divergent thinking. Each construct is discussed in more detail below.

Figure 2.1 Conceptual framework

Creative problem solving is the outcome construct of interest for this study. This study follows MCU’s Quality Enhancement Plan to define creativity as more than just novel ideas—these ideas must also be useful and be able to be put into practice (Amabile, 1998; Berger, 2019; MCU, 2015). Additionally, students should be able to provide a plan for implementation to turn an abstract idea into a functional process, including enough detail to be able to be put into practice. In MCU’s Quality Enhancement Plan (2015), creativity is defined as creative problem-solving that focuses on the novelty and usefulness of the products developed by students. Following Amabile (1982), MCU specifically designed the Quality Enhancement Plan to focus on the usefulness of
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products, not necessarily the creativity of the individuals who made them (MCU, 2015). Thus, MCU narrows the consideration of creativity itself, which may manifest in multiple ways, to a consideration of how creative thought is applied in practical solutions to problems of import to the national security of the U.S. and its allies (MCU, 2015).

The remaining constructs are factors that might contribute to the creativity construct in military graduate students. Divergent thinking and metacognition, defined above, are separate but related contributors to creative problem-solving. A potential barrier to creative problem-solving, especially to the influence of divergent thinking, is military authoritarianism, which is the preference for solutions deriving from existing authority and the deference to superior ranking officers due to a reticence to question their decisions and opinions (Aylesworth & Cleary, 2019; Chiu & Tu, 2014; Ericksen, 2015; Kayaalp, 2018; Kirkhaug, 2009; Sandwith et al., 2017; Smaliukiene & Survilas, 2018; Zaccaro et al., 2015). Moreover, when the primary indicators for good decision-making are speed and decisiveness, as in combat or in scenarios based on combat, the incentive to advocate for divergent points of view is further reduced.

Other factors include student time, student motivation and subject matter knowledge. Student opportunity indicates the degree to which students have the resources to think creatively, with time being the chief resource (Amabile & Pratt, 2016). Student motivation reflects whether or not students are intrinsically motivated to think creatively and how that motivation relates to the extrinsic motivation deriving from Marine Corps and MCU policy (Amabile & Pratt, 2016; Bryant & Urben, 2017; Hitt, 2016). Subject matter knowledge in a field is a critical factor for creativity and is foundational for
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creative problem-solving in that field (Amabile & Pratt, 2016; Brown et al., 2014; Mumford & Gustafson, 2007).

**Purpose of the Study**

The purpose of this study is to examine factors related to creative problem-solving within a professional military education context. The scope of this study is a 2020-2021 cohort of mid-career military officers and federal government employees at MCU’s CSC. The significance of their mid-career status is discussed above. The unit of analysis is the individual student or the products that individual students created.

**Research Questions**

1. To what degree do students in a professional military education context:
   a. Perceive the environment to encourage divergent thinking,
   b. Appeal to authoritarianism or perceive the environment to be authoritarian,
   c. Perceive that they have the time necessary to think creatively,
   d. Perceive that they have the requisite subject matter knowledge and research literacy,
   e. Practice metacognition, and
   f. Demonstrate motivation to think creatively?

2. To what degree do faculty in a professional military education context perceive that:
   a. the environment encourages divergent thinking,
   b. the environment is authoritarian,
   c. students have the necessary subject matter and research literacy,
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d. students have the time necessary to think creatively, and
e. students are motivated to think creatively.

3. How do students perform on assessments related to creative problem solving and how do these assessments relate to the above factors?

4. How do faculty and students in a professional military education context describe the environment for creative problem solving at MCU?

Population

For the student-related research questions, the population is 209 mid-career military officers and civilian federal employees enrolled at the Marine Corps CSC (MCU, 2022a). For academic year 2022, 110 of the students were Marine officers, while the others are a mixture of other service US officers (n=52), interagency civilians (n=15), or international military officers (n=32) (MCU, 2022a). The faculty population is 60 faculty members who lecture, lead seminars or mentor theses for students at Marine Corps CSC. Half (n=30) of these faculty are civilians with doctorates in international relations, military history, government and other related areas. The other half of the faculty are military officers who are usually senior in rank and in experience to the students (n=27) or interagency civilians with experience in other elements of the federal government (n=3). All of these military faculty and civilian interagency faculty are required to have at least master’s degrees (MCU, 2020a). One of the interagency civilian faculty members and two of the military faculty members also have doctorates. Most military faculty members have commanded at the battalion or squadron-level and all have recent operational experience. These populations of students and faculty are appropriate to the research questions because they are students and faculty at a professional military
education school that is certified by the Department of Defense’s Process of Accreditation for Joint Education and is regionally accredited (MCU, 2021b).

**Positionality**

As a Marine Corps officer and a staff member at MCU working in academic affairs and a graduate of the non-degree, non-resident version of Marine Corps CSC, I have familiarity with the context. When the needs assessment began, I held the same rank as the students in the population. Shortly after completion of cognitive interviews, I was promoted and now hold the same rank as the majority of the military faculty at the College. In both cases, I am not in a position of supervisory authority over any of the participants.

Anecdotally, I remember writing essays long into the night at Officer Candidate School in 2002 about the importance of uniformity, assigned as punishment whenever I made a mistake that differentiated me from my peers. As a white male military officer serving over the past two decades, I have been a witness to a changing Marine Corps culture, with enhanced respect for diversity, but a culture that continues to struggle with acceptance of the principles of diversity and inclusion and the value that diversity provides for creative problem-solving. Moreover, I have served as an advisor to the Iraqi Army and a liaison to the Republic of Korea Marines. Along with the rest of the national security community, I have witnessed both tactical success and strategic failure.

**Methodology**

This project uses a convergent parallel mixed methods design with two primary methods of data collection (Creswell & Plano-Clark, 2018). They are survey methodology and secondary data analysis. Survey methodology was augmented by
cognitive interviews to help ensure validity and reliability of the questions (Desimone & Le Floch, 2004; Porter, 2011). For the main construct, creative problem-solving, the needs assessment used secondary data analysis of student survey responses related to creativity on MCU’s annual student survey of students who graduated in 2021. This survey gathered both quantitative and qualitative responses.

Additionally, for MCU’s Quality Enhancement Plan, each year the University assessed random samples of papers and exercises using the Association of American Colleges and University’s (2009) Creative Thinking value rubric and Amabile’s (1982) consensual assessment technique (MCU, 2015; 2021a). The current project does not re-evaluate any student artifacts but draws on these existing evaluations conducted as a part of the assessment of the Quality Enhancement Plan (MCU, 2021a). These evaluations were publicly reported for academic years 2015-2020 and obtained via a secondary data request for academic year 2021 and the first half of academic year 2022.

Furthermore, this needs assessment includes student and faculty surveys using questionnaires developed by the researcher. While the faculty survey was anonymous, the student survey gave students the option of providing their name so that the researcher could compare their survey responses with QEP assessment scores, grades on select assignments, and first semester GPAs. Students were not required to provide their names and the purpose for requesting their names was made clear. After scores, GPAs, and grades were matched to the applicable responses, the data were deidentified and names were not retained.

For the contributing factors, this project drew from four different sources to develop survey questions for faculty and students. As discussed below, the survey
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questions drew primary inspiration from two surveys created by Alencar and Fleith (2010; 2014)—one for faculty and one for students—relating to teaching practices and barriers to creativity in the higher education context. Additionally, the student survey borrowed several questions from the Metacognitive Awareness Inventory (Schraw & Dennison, 1994). Lastly, responses to Potter’s (2013) open-ended survey of barriers and incentives to creativity in a higher education context also influenced some of the survey questions. Survey questions included in both final surveys relate to contributing factors of creative problem solving. These factors include divergent thinking, authoritarianism, student knowledge, student opportunity and motivation, and metacognition. These contributing factors emerge from the conceptual framework of this study. Surveys also included optional open-ended questions at the end.

Consensual Assessment Technique

The consensual assessment technique method employs subject matter experts to evaluate the creativity of products (Amabile, 1982). Three other studies have used the consensual assessment technique to evaluate the creativity of products created by Australian Air Force officers and US Army officers in a professional context (McConnell et al., 2023; Sandwith et al., 2017; Vincent et al., 2002). Another study, conducted in a U.S. civilian graduate school context with a multicultural cohort of students, also used the consensual assessment technique to evaluate final papers after exposure to multicultural dialogue in a semester-long course (Matić, 2019). A particular strength of the consensual assessment technique is that it looks at the products themselves and not the personality or cognitive style of the creators (Amabile, 1982). Importantly, those assessing product
creativity are experts in the field, who focus on the creativity of the products and not necessarily on technical matters like writing style and grammar (Amabile, 1982).

Amabile (1982) claims that one strength of the consensual assessment technique is the fact that experts exercise their own independent judgement about what constitutes creative work, so the consensual assessment technique does not provide any information about the inputs that go into a creative product. While Amabile (1982) argues that evaluators should not be trained or given specific criteria, MCU actually used a rubric and sometimes conducted two-stage norming (AAC&U, 2009; MCU, 2021a). Even so, the use of the consensual assessment technique is compatible with Amabile’s (1988; Amabile & Pratt, 2016) componential model of creativity and innovation, in which an individual’s creative products emerge from the interaction between intrinsic motivation, subject matter expertise, and mastery of the tools necessary to create. These three factors were three of the main factors in the surveys described below.

In the MCU context, the products assessed were student papers or exercises (MCU, 2015; MCU, 2021a). MCU used a modified version of the Association of American Colleges and Universities (2009) Creativity VALUE rubric and conducted norming sessions amongst faculty selected as experts in the field (MCU, 2021a). The University used the consensual assessment technique every year from 2015-2022 (MCU, 2021a). Major advantages of continuing to use the consensual assessment technique for this study are that several years’ worth of assessments have been completed, that the tool is understood and accepted within the University, and that each year a random sample of student papers or exercises are evaluated.
Annual Survey Secondary Data

Each year MCU surveys the students of its residential programs. There are three master’s degree-granting 10-11 month long residential programs and one 10 month long non-degree residential program. The student survey is generally released in June. The survey goes to all residential students, not a sample. The population of interest for this dissertation is students in CSC, which is MCU’s largest degree-granting residential program. The annual student survey collects information about military service affiliation (e.g. US Marine Corps) and program affiliation (e.g. CSC). It does not collect any additional demographic information. Though not focused specifically on creativity, the survey asks students about their perceptions of whether and how much their creative problem-solving ability improved. It also asks what the most significant influences were on their creative problem-solving ability as well as open ended questions about barriers to creativity that they encountered and what recommendations they might have to enhance creative problem-solving (MCU, 2020c).

Faculty and Student Surveys

In addition to the secondary data analysis, this needs assessment draws on surveys that the author developed for students at CSC and for faculty who are affiliated with CSC as either full-time or adjunct faculty. The purpose of using surveys in this needs assessment was to determine to what extent factors identified in the literature as related to creative problem solving are present in students and their context at MCU. Ultimately, the results of the surveys help to inform curriculum innovation to foster creativity in MCU students. In choosing to conduct surveys instead of focus groups or interviews, the researcher focused primarily on their utility for deductive studies, in that the factors
involved derive from Amabile’s (1988; 1998; & Pratt, 2016) work on creativity and the intent was to determine if those same factors exist at MCU (Lochmiller & Lester, 2017). Additionally, surveys are useful for this project based on their utility for efficiently gathering information about a large population (Allen, 2016). Surveys generally help to provide descriptive information about a population and they can also be used to test whether factors in a theory are present in one’s context (Lochmiller & Lester, 2017).

One disadvantage of surveys is that they are more difficult to adapt to unique contexts like that of the U.S. military (Allen, 2016; Knight, 2003). For this reason, as discussed below, the survey instrument for this study is primarily new. Though all questions are supported by the conceptual framework discussed in chapter one, some are also inspired by other surveys about fostering creativity in higher education, including graduate higher education (Alencar & Fleith, 2010; Alencar & Fleith, 2014; Fleith & Gomes, 2019; Potter, 2013). Because the new surveys have been tailored to the MCU environment, if they prove to be valid and reliable, they might later be tested for their generalizability and use at other U.S military institutions of higher education (Allen, 2016).

Survey Development

The survey questionnaires used in this study include a mix of demographic questions, multiple-choice questions and open-ended questions. The multiple-choice questions for both surveys used a five-point Likert scale for responses (Allen, 2016). They rest primarily on Amabile’s (1988; Amabile & Pratt, 2016) componential model of creativity and innovation. Each survey questionnaire includes four to five questions related to each of the factors identified in the first two research questions, except that
metacognition is only present in the student survey. For an examination of how the survey questions relate to these constructs, see appendices B and C. The open-ended questions are included in order to give respondents a chance to provide additional details about their opinions (Lochmiller & Lester, 2017). The questions are rooted in the literature around creative problem-solving and the researcher drafted all of the questions in consultation with the dissertation advisor.

Several researchers have established a positive relationship between divergent thinking and creative problem-solving and a negative relationship between authoritarianism and creative problem-solving, so divergent thinking and authoritarianism are both constructs of special interest for these surveys (Aylesworth & Cleary, 2019; Chiu & Tu, 2014; Kayaalp, 2018; Kirkhaug, 2009; Sandwith et al., 2017; Smaliukiene & Survilas, 2018; Vincent et al., 2002; Zaccaro et al., 2015). Additionally, the secondary data analysis described below found time, or the lack thereof, to be an important factor for creative thinking in this context, so time was another key focus of data collection. Finally, some research indicates that students might benefit from metacognitive strategies to encourage divergent thinking and reflection, leading to increased creativity, which made metacognition a special area of interest (Chua, 2012; Khachadoorian et al., 2020; Ku & Ho, 2010).

**Previous Surveys Providing Inspiration for the Needs Assessment Survey**

Alencar and Fleith (2010; 2014) developed two surveys in the higher education context to determine what factors faculty consider to be barriers to creativity and which pedagogical practices related to creativity students report that their faculty use. In order to better fit the MCU context and the models above, this study does not adopt those surveys.
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directly, but it drew inspiration for many of its questions from these two surveys. All questions were significantly re-worded. The largest number of questions are inspired by Alencar and Fleith (2014).

Alencar and Fleith (2014) identified 5 factors from 38 questions on their Inventory of Teaching Practices. They developed the Inventory of Teaching Practices using student and faculty open ended surveys and the final survey included a faculty version and a student version. For the factor analysis, respondents were students in higher education. One factor, related to the amount of time needed for thinking creatively, was present in only one item and that item was not loaded on any other factors, so it was dropped. Notably, the factor of time was reported often in open ended surveys used in the development of the Inventory of Teaching Practices and is present in at least one other higher education creativity survey (Alencar & Fleith, 2014; Potter, 2013). The remaining factors are Incentive to New Ideas, Climate for Expression of Ideas, Evaluation and Teaching Methodology, and Interest for Students’ Learning (Alencar & Fleith, 2014).

Fleith and Gomes (2019) modified the Inventory of Teaching Practices for the graduate school context and found that these four factors had too much co-variance. Of note, Evaluation and Teaching Methodology co-varied the most (above 1.0) with Climate for Expression of Ideas and with Interest for Students’ Learning. Incentive to New Ideas and Climate for Expression of Ideas were the least correlated factors (.974). The authors developed a new model with better fit that included all of the items except one in a General Factor as well as the factors for Climate for the Expression of Ideas and Evaluation and Teaching Methodology (Fleith & Gomes, 2019). In the interest of keeping the length of the survey down, the needs assessment study for this current project did not
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replicate all questions in each factor, but chose questions most related to the constructs of special interest to this study.

Questions from Alencar and Fleith (2010) also inspired the present study. Their survey provided higher education faculty with a list of 20 potential barriers to promoting student creativity and asked them to indicate (yes or no) if they believed an item to be a barrier (Alencar & Fleith, 2010). The researchers published the results in a Portuguese language article, which the current researcher used Google translate, Microsoft translate, and his own limited knowledge of Portuguese to read.

Additionally, this project derived inspiration from Potter’s (2013) open ended survey of higher education faculty concerning barriers and aids to student creativity. Potter asked faculty in higher education to list three barriers and three incentives to creativity in higher education and received 83 unique barriers and 83 unique incentives from 954 and 895 responses, respectively. Of the barriers, 12 were present in 2% or more of the responses and 22 were present in 1% or more of the responses. Of the incentives, 16 were present in 2% or more of the responses with 25 present in 1% or more. For instance, Potter (2013) reported academic freedom as the 17th most common incentive to promote creativity in higher education and fear and risk aversion as the 13th most common barrier. Other incentives to creativity included evaluation, while barriers include the difficulty of assessing creativity, student apathy, and lack of time (Potter, 2013).

The questions related to metacognition, unlike the others above, are drawn directly from Schraw and Dennison’s (1994) Metacognitive Awareness Inventory. The two factors Schraw and Dennison reported were Knowledge of Cognition and Regulation of Cognition. For the current study’s student survey, from the 52-item Metacognitive
FOSTERING GRADUATE STUDENT CREATIVE PROBLEM SOLVING

Awareness Inventory, this author selected three questions from each factor based on their theoretical relevance to creative problem-solving.

**Reliability and Validity of the Needs Assessment Surveys**

Researchers responsible for each of the surveys that inspired the present study’s questions conducted their own reliability and validity measurements (Alencar & Fleith, 2014; Fleith & Gomes, 2019; Potter, 2014; Schraw & Dennison, 1994). Because the current versions of the faculty and student surveys are amalgamated from questions from multiple researchers and multiple surveys, the researcher did cognitive interviews to enhance their validity (Desimone & Le Floch, 2004). Additionally, this author conducted a confirmatory factor analysis on each of the theoretical constructs (Agresti & Finlay, 2009). See below for a discussion of the factor analysis.

As an initial test for the validity of the questions on the faculty survey questionnaire, the researcher conducted cognitive interviews with four participants who were either current or former faculty members at MCU. In order to preserve the number of CSC faculty who could later complete the questionnaire, none of the faculty who participated in cognitive interviews was a current CSC faculty member. Three of the interviewees were men and one was a woman. One was African-American and the other three were White, Non-Hispanic. Of the four participants, two were civilians and two were military members holding the same rank as the interviewer at the time of the interview.

Similarly, as an initial test for the validity of the questions on the student survey questionnaire, the researcher also conducted cognitive interviews with five military
officers who had graduated from intermediate-level professional military education schools. None of the five interviewees was a student at CSC within the past five academic years. At the time of the interview, two held superior military rank to the interviewer and three held the same military rank as the interviewer. One was a woman. Three were Hispanic, and the other two were White, non-Hispanic.

The researcher conducted the cognitive interviews using the think aloud method in order to increase the validity of the questions by making sure that questions were worded clearly and that participants understood them as intended (Desimone & Le Floch, 2004). In accordance with IRB protocols, cognitive interviews were conducted virtually to prevent the spread of COVID-19. All interviewees were personal friends or acquaintances of the researcher, recruited via email. All participants consented verbally to the cognitive interviews and filled out consent forms. After each interview, the researcher revised the applicable questionnaire or made comments on the questionnaire to address later, sometimes asking later participants to weigh-in on recommendations of earlier participants (while still keeping all participant names anonymous).

Following completion of the cognitive interviews, the researcher made several changes to the question-wording on each questionnaire in order to clarify the meaning of the questions and then submitted the revised questionnaires as an amendment to the IRB. For example, one question asked about learning strategies, but military students and faculty who participated in the cognitive interview expressed confusion over the use of the word “strategies,” which implies in the military context, a much wider scope of responsibility than was intended by the question. As a result, the word “strategies” was replaced in the final version of the survey with the word “tactics,” which implies action
taken at the individual or small group level. Additionally, some questions were added to the survey based on suggestions from the cognitive interviewees’ experiences as students or faculty at MCU. These questions included items inquiring about how useful the required and supplemental seminar preparation materials (e.g. readings, videos) were for creative thinking.

**Procedures**

Due to the relatively low number of students and faculty in the population at CSC, surveys were sent to every student and eligible faculty member, rather than a sample. The survey platform used was max.gov and the order of the closed-ended questions was randomized. Upon approval from the U.S. Marine Corps IRB and Johns Hopkins University IRB, the researcher received email addresses for eligible faculty and students at MCU. The researcher sent IRB-approval email solicitations that identified the purpose of the study, the consent required, confidentiality, and the link for each survey. Of particular note, the researcher, though he is a staff member at MCU, made it clear in consent forms and solicitations that he was conducting the research in his personal capacity as a student at Johns Hopkins and not as a staff member at MCU. Survey links were sent automatically by max.gov. Likewise, even though in his professional capacity the researcher currently has access to much of the secondary data required, the researcher received approval from the President, MCU for access to secondary data by an outside researcher.
Summary of Results and Key Findings

Secondary Data: Student Annual Surveys

For the annual student survey for the 2020-2021 academic year, the researcher obtained secondary data in the form of responses to questions related to creative problem solving. In the close-ended questions, students were asked to indicate on a five-point Likert scale from strongly agree to strongly disagree if their creative problem-solving skills improved as a result of attending CSC. The responses were normally distributed and centered on “agree” with a very small tail toward disagree. See Table 2.1.

Table 2.1: Student responses to prompt asking if they improved their creative problem-solving skills as a result of attending CSC

<table>
<thead>
<tr>
<th>Response</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>20</td>
<td>25.6%</td>
</tr>
<tr>
<td>Agree</td>
<td>35</td>
<td>44.9%</td>
</tr>
<tr>
<td>Neutral</td>
<td>20</td>
<td>25.6%</td>
</tr>
<tr>
<td>Disagree</td>
<td>2</td>
<td>2.6%</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>1</td>
<td>1.3%</td>
</tr>
</tbody>
</table>

In total, 78 students responded to this question and 70.5% of students indicated that they agreed or strongly agreed that their creative problem-solving skills improved as a result of attending CSC. Another 25.6% of students were “neutral.” Only three students indicated that they disagreed or strongly disagreed. As with all related survey questions, MCU has established a goal of 80%. For the purposes of distributing survey results to the faculty and staff, MCU excludes the neutral responses from the data, which results in the finding that greater than 96% of students perceived that they improved their creative problem-solving skills. In any case, it is true that less than 4% of students disagreed that they improved their creative problem-solving skills. On the other hand, if neutral responses are included in the data, then MCU failed to meet its goal of greater than 80%
of students indicating that they agreed that their creative problem-solving skills improved as a result of attending CSC.

**Figure 2.2: Most significant influences on improvement of creative problem solving**

*Figure 2.2: Most significant influences on improvement of creative problem solving (n=78)*

When filtering for only respondents who did not agree that they improved their creative problem-solving skills as a result of attending CSC, the same four leading influences emerged, but the role of individual research was the only influence above 50%
(65.2%). The three other leading influences, each related to working together in groups, were all between 40% and 50%.

**Figure 2.3: Most significant influence on creativity improvement amongst those who were neutral or disagreed that their creativity improved at CSC (n=23)**
After answering the above question, students were given the opportunity to provide additional open-ended comments. Two positive themes emerged. The most prominent theme was praise for the classroom environment, including the faculty and peers. For instance, when given the opportunity to describe significant influences on their creativity, one student said: “I thought the experiences of the MILFACs [name redacted] and my fellow students based upon their past experiences was very valuable.” Another positive theme was the opportunity to take electives (even though only 2 of approximately 41 credits were electives). Negative themes that emerged were that wargames and exercises were not helpful and that the focus on creating conventional planning products detracted from the ability to think creatively, both in time and structural constraints. One student, on the other hand, strongly recommended more wargaming.

Students were then given the opportunity to provide open ended responses concerning barriers to developing creative problem-solving skills at CSC. One theme that emerged here was the impact of COVID (including difficulties with the virtual environment, the shortened academic year, and facemasks). Another major theme, as above, was the perceived focus at the College on products for briefs rather than on creativity. For instance, one student said, “The focus was product-driven for briefs to MILFACs and pleasing retired Generals, not at actual creative problem solving for future operating environments.”

Relatedly, many students felt that assignments and feedback incentivized conventional thinking rather than unconventional. A key theme was the lack of time to think creatively about what the students were learning. One student said,
The fire hose effect of pushing material onto students without affording them the opportunity to stop, think critically, and then apply what you learned… If you force 80 plus pages of reading a night, which takes time to read, comprehend, and digest, students don’t have time to think critically about what they learned and apply it to further studies. It turns into a one-night digestion where you regurgitate it the next day and move onto the next 80 pages of reading.

Lastly, some students complained that faculty did not support students who provided diverse opinions, “challenged the status quo” or engaged in “out-of-the-box thinking.”

At the end of the survey questionnaire, students had the opportunity to provide open-ended responses to a prompt asking for their recommendations to improve MCU’s efforts related to creative problem-solving. Without a doubt, the focus of the majority of the responses to this question was wargaming and other exercises. Some students recommended cutting specific exercises from the curriculum while others (fewer) recommended adding more exercises and wargaming.

Other students focused on the conduct and structure of the exercises and wargames. Many students felt that the execution of these games was too rigid in that they did not allow for time to think and create, the focus was on briefing products, or the exercises did not accommodate outside the box solutions. Other less common themes that emerged were praise for the way Socratic seminars were conducted and a concern that there was not enough time in the schedule to think critically and creatively (mostly that there was too much required reading and that this came at the expense of time to think).
Secondary Data Analysis of Student Creative Problem-Solving Ability

The University assessed the creativity of student products for its accreditation-related Quality Enhancement Plan. Table 2.2 Reports the results of these assessments for CSC. The University used Amabile’s (1982) consensual assessment technique to rate the creativity of student products. The University augmented Amabile’s technique with the AAC&U’s (2009) creative thinking value rubric, which identifies the following six components of creative thinking: acquiring strategies and skills, embracing contradictions, connecting and synthesizing, innovative thinking, solving problems, and taking risks. For each of these components, the rubric provides criteria to assess the students’ work on the following scale: not demonstrated (0), imitative (1), adaptive (2), creative (3), and transformative (4) (AAC&U, 2009). Starting in academic year 2017, the University conducted norming sessions for raters, but rigorous norming was not conducted in the COVID impacted 2020 and 2021 years. After each rater provided a score for each component, the scores were then averaged and the result was rounded to the nearest whole number. For student products rated by more than one rater, the two rater’s scores were averaged. MCU’s goal was that 80% of students would score as creative or transformative.

<table>
<thead>
<tr>
<th></th>
<th>AY15</th>
<th>AY16</th>
<th>AY17</th>
<th>AY18</th>
<th>AY19</th>
<th>AY20</th>
<th>AY21</th>
<th>AY22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>7%</td>
<td>13%</td>
<td>69%</td>
<td>1%</td>
<td>13%</td>
<td>3%</td>
<td>4%</td>
<td>8%</td>
</tr>
<tr>
<td>Spr</td>
<td>13%</td>
<td>69%</td>
<td>81%</td>
<td>1%</td>
<td>13%</td>
<td>3%</td>
<td>4%</td>
<td>8%</td>
</tr>
<tr>
<td>Fall</td>
<td>81%</td>
<td>1%</td>
<td>13%</td>
<td>3%</td>
<td>4%</td>
<td>4%</td>
<td>8%</td>
<td>39%</td>
</tr>
<tr>
<td>Spr</td>
<td>13%</td>
<td>3%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>8%</td>
<td>39%</td>
</tr>
<tr>
<td>Fall</td>
<td>3%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>8%</td>
<td>39%</td>
</tr>
<tr>
<td>Spr</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>8%</td>
<td>39%</td>
</tr>
<tr>
<td>Fall</td>
<td>8%</td>
<td>39%</td>
<td>49%</td>
<td>40%</td>
<td>45%</td>
<td>52%</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

The assessments for academic years ending in 2015 through 2020 are reported in MCU’s impact report of the Quality Enhancement Plan (MCU, 2021a). The results for the academic years ending in 2021 and 2022 were obtained via the researcher’s
secondary data analysis request. Of note, the impact report states that the academic year 2016 results reflect the use of a discarded assessment tool and should not be compared to the results in other years (MCU, 2021a). The results for the final three academic years are substantially different than all other years except academic year 2016. In personal conversation, faculty attribute the improvement in 2020 and 2021 to a change in the prompt. For academic year 2022, faculty evaluated student creative problem solving on a staff ride to Chancellorsville. The specific product to be evaluated on the staff ride was an oral presentation, unlike all previous years when a paper was evaluated. A staff ride is designed to pose key operational questions to students on an actual historical battlefield, with some details of the scenario rearranged in order to encourage students to think creatively about potential actions without merely parroting the historical facts (Wineman et al., 2018). Regardless of whether the student work evaluated was a paper or a practical exercise like a staff ride, in every year except academic year 2016, when a different assessment tool was used, CSC did not meet its goal of 80% of students producing work that was creative or transformative.

For the academic year ending in 2021, the researcher obtained more detailed information about these assessments, including the papers assessed and the differences between the ratings of the military and civilian faculty at CSC. For the fall semester, the rated essay was an analytic essay on grand strategy and rouge states that was part of the course called National Security Affairs and the International System. The civilian faculty were the primary instructors for this course and the essay was due at the end of the semester. The prompt asked students to either assess the current state of US grand strategy or to craft a new US policy toward Iran or North Korea.
For this paper, civilian faculty scored 120 papers using the rubric and military faculty scored 150 papers. Of these papers, 79 were scored by both a civilian faculty member and a military faculty member. Overall, 40% of papers were assessed to be creative or transformative. For the 79 papers assessed by both a military and a civilian faculty member, the average score as assessed by civilian faculty was 2.3, while the average score as assessed by military faculty was 2.7. Thus, the civilian faculty rated student creativity, on average, almost half a point lower than the military faculty. Moreover, the civilian faculty found only 41% of these papers to be creative or transformative while the military faculty found 63% of the same papers to be creative or transformative.

There were 23 papers for which the average score differed between raters by one point or more. On all but four of these instances, the civilian faculty member’s rating was lower than the military faculty members. For a further 16 papers, the average scores differed by less than one point but more than a half a point. For only three of these papers was the civilian faculty member’s rating higher than the military faculty member’s rating. Overall, taking the average scores for each paper, there was more than half a point difference between the military and civilian faculty ratings on 49% of the papers.

For the spring semester, the papers evaluated were part of a class called Leadership in the Profession of Arms II, for which the military faculty are the primary instructors. The prompt asked students how the American military might be wrong and how to fix it. Overall, 45% of papers were assessed to be creative or transformative, but substantial differences emerged when comparing the scores of the military faculty raters to the scores of the civilian faculty raters. Of the 46 papers civilian faculty rated, they
found that 76% were creative or transformative. On the other hand, of the 54 papers that military faculty rated, they found that only 24% were creative or transformative. Only 14 papers were assessed by both a civilian faculty member and a military faculty member. Within this set of papers, the average rating from the civilian faculty was 3.1 while the average rating from the military faculty was 2.6, exactly half a point lower. Overall, for half of the papers rated by two faculty members, the average scores were over half a point different between raters. Moreover, of these 14 papers, civilian faculty rated 92% of them as creative or transformative, while military faculty rated only 57% of the same papers as creative or transformative.

Considering both semesters together, an interesting pattern emerges for those papers evaluated by both a civilian faculty member and a military faculty member. The civilian faculty members, on average, rated the same paper lower than military faculty for a subject in their general areas of academic expertise (National Security Affairs and the International System). Meanwhile, for a subject in the military faculty’s general experiential area of expertise (Leadership), the military faculty rated students lower, on average, than the civilian faculty. So, in both cases, the area of faculty expertise seems to have negatively influenced the perception of student creativity in that area. See Table 2.3.

Table 2.3: For academic year 2021, percent of papers rated creative or transformative (amongst papers rated by two faculty members)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Military Faculty</th>
<th>Civilian Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Security (Fall)</td>
<td>79</td>
<td>63%</td>
<td>41%</td>
</tr>
<tr>
<td>Leadership (Spring)</td>
<td>14</td>
<td>57%</td>
<td>92%</td>
</tr>
</tbody>
</table>
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Academic Year 2022 student assessments and grades

CSC used a staff ride exercise to evaluate student creativity in academic year 2022. For the first semester, students went to Chancellorsville for the exercise on the 9th and 10th of November. Faculty conducted 211 evaluations of creativity for 145 students, based on oral presentations at the staff ride. For those students who were evaluated twice, their scores were averaged. Fifty-two percent of students were adjudged to have produced creative or transformative work on the staff ride. Table 2.4 below shows descriptive statistics for their scores for each element of the AAC&U (2009) creative thinking VALUE rubric. The percentage of students adjudged to be creative or better (50%) who provided their names on the student survey discussed below and were evaluated on the QEP (n=16) was very similar to the total percentage of students in academic year 2022 who were adjudged to be creative or better (52%).

Table 2.4 also shows student grades on two essays that were designed to evaluate student achievement on learning outcomes related to critical and creative thinking. The first essay was the 3100B future war and innovation essay from a course entitled the Evolution of Modern War. This essay asks students to describe lessons that today’s national security community might learn from decision-making between World Wars I and II. It was submitted in December. Another essay, on great power competition, asked students to propose changes to US strategy or policy. This essay was due in November and was part of the course entitled 4100 National Security Affairs and the International System. Table 2.4 below shows the average grades for each of these essays. Students who provided their names on the student survey in December (n=27) had average scores on
these essays that were within one percentage point of the overall average for the 3100B essay and one tenth of a percentage point of the overall average for the 4100B essay.

Additionally, Table 2.4 shows the average first semester GPA for all students. The average first semester GPA for students who provided their names on the student survey in December was within .05 points of the overall average GPA. Thus, there was substantial similarity in outcome measures (GPA, essay grades, QEP performance) between students who submitted their names on the student survey discussed below and those who did not submit their names.

**Table 2.4: Descriptive statistics for GPA, grades, and QEP assessments (n = 209)**

<table>
<thead>
<tr>
<th>Grades</th>
<th>QEP assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st semester</td>
<td>Acquiring Strategies</td>
</tr>
<tr>
<td>3100B essay</td>
<td>Embracing Contradictions</td>
</tr>
<tr>
<td>GPA</td>
<td>Connecting and Synthesizing</td>
</tr>
<tr>
<td>grade</td>
<td>Innovative Thinking</td>
</tr>
<tr>
<td>4100B essay</td>
<td>Solving Problems</td>
</tr>
<tr>
<td>grade</td>
<td>Taking Risks</td>
</tr>
<tr>
<td>Mean</td>
<td>Total</td>
</tr>
<tr>
<td>3.67</td>
<td>90.99% 90.05%</td>
</tr>
<tr>
<td>Stdev</td>
<td>0.25 3.45% 3.70%</td>
</tr>
<tr>
<td>Min</td>
<td>2.7 82% 80%</td>
</tr>
<tr>
<td>Max</td>
<td>4.0 98% 98.25%</td>
</tr>
</tbody>
</table>

Note: Goal for QEP is that 80% of students will score a 2.5 or higher.

**Theses**

Finally, using a publicly available database of student theses, this author selected a random sample of 30 theses to determine how many of the theses use at least basic empirical research methodology (Marine Corps Research Library, 2021). Basic empirical research methodology is defined as a study conducted by the student that goes beyond a literature review and research question, where the population to be studied, the
methodology, the findings, and a discussion are reported (Penn State University, 2021). For the purposes of the analysis, because the focus is on social science research methodology, historical case studies were not considered to be “empirical” research. Of course, there is nothing wrong with theses that do not use empirical research methodology, but the number and quality of theses in which the students conduct empirical research is a potential indicator for their understanding of such research.

In the sample of 30 theses reviewed, all from academic year 2021, four were identified in which the student conducted basic empirical research, though none of them could be said to be experimental or quasi-experimental (Shadish et al., 2002). Of those four theses, two won awards. Of the remaining 26 theses reviewed, one other thesis won an award and the thesis was a historical case study. For comparison purposes, a total of 15 students across CSC in academic year 2021 received writing awards. Some of these were for other papers, not the thesis.

Quantitative survey results

Surveys for faculty and students were developed to measure factors related to creativity in professional military education. Both faculty and student surveys were open from 2-31 December 2021. Thus, they reflect faculty and student thoughts at the end of the first semester of the year and they occurred within a reasonably close time to the QEP assessment, essay grades and first semester GPA described above. These surveys used a five-point Likert scale (1= strongly disagree to 5= strongly agree) for questions in the following factors: divergent thinking, authoritarianism, student knowledge, time, motivation, and metacognition. A total of 66 students and 31 faculty members responded
to the surveys (see Table 2.5). In the section that follows, each factor will be examined in
greater detail.

**Table 2.5: Survey respondents**

<table>
<thead>
<tr>
<th></th>
<th>Students</th>
<th>Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Marine</td>
<td>Interservice</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>18</td>
</tr>
</tbody>
</table>

**Factors**

Questions related to each factor are listed in the appendix B and appendix C. Each
survey had three to five questions about each factor, except that the factors related to
student metacognition only appeared on the student survey. For those factors present in
both the student and the faculty surveys, most questions on the student survey had
parallel versions on the faculty survey, with no more than one question per factor not
parallel (for the factor of time and opportunity, all questions on the student survey had
parallel questions on the faculty survey). Table 2.6 summarizes faculty and student
survey results for each construct.

**Table 2.6: Average and Standard Deviation for each factor**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Faculty (n=31)</th>
<th>Students (n=66)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std Dev</td>
</tr>
<tr>
<td>Divergent thinking</td>
<td>3.97</td>
<td>.59</td>
</tr>
<tr>
<td>Authoritarianism</td>
<td>2.26</td>
<td>.64</td>
</tr>
<tr>
<td>Student knowledge</td>
<td>3.33</td>
<td>.81</td>
</tr>
<tr>
<td>Time and opportunity</td>
<td>2.59</td>
<td>.83</td>
</tr>
<tr>
<td>Motivation</td>
<td>3.46</td>
<td>.78</td>
</tr>
<tr>
<td>Metacognition (knowledge of cognition)</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Metacognition (regulation of cognition)</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>
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Three of the five questions on each survey that were related to authoritarianism were reverse coded to ensure that high scores on authoritarianism meant the students had authoritarian attitudes. Similarly, one question on the time and opportunity scale was reverse coded to ensure that high scores on this factor meant that students/faculty felt that students had enough time to think creatively at CSC. Overall, faculty and students had remarkably similar scores for each of the factors that were included in both surveys. Unexpectedly, given the relative sample sizes, standard deviations for most of the factors were higher in the student survey than in the faculty survey. This fact suggests greater variability amongst the student body concerning perceptions of the CSC environment.

As would be hoped, amongst factors on both surveys, students and faculty reported the highest average scores for divergent thinking and these scores had the lowest standard deviation. There seems to be general agreement that divergent thinking is encouraged and practiced at CSC. Both groups also averaged below the mid-point of the Likert scale for authoritarianism, which is a good sign. On the negative side, for students, the factor for time and opportunity had the lowest average score of any of the constructs. The scores on this factor indicate that students, on average, did not think that they had enough time to think creatively about the content of the curriculum. Moreover, the faculty largely agreed that students do not have enough time to think creatively.

Both faculty and students returned relatively high average scores for motivation and student knowledge. These student knowledge scores comprise knowledge of the content as well as knowledge of research methodology. One possible reason that both faculty and students report a lack of time is that there is so much content to cover. Yet,
the results of these surveys indicate that the students and faculty feel relatively comfortable with student knowledge.

Finally, for the two factors related to metacognition, students reported their highest average scores. Students seem comfortable with their understanding of how to process information (knowledge of cognition) and their ability to control their thinking while solving problems (regulation of cognition). Taken together, the three factors related to thinking skills (divergent thinking, knowledge of cognition, and regulation of cognition) had the three highest average scores and the three lowest standard deviations on the student survey. Students are very confident in their thinking skills.

**Confirmatory Factor Analysis**

Student surveys included the following theoretical factors: divergent thinking, authoritarianism, student knowledge, time and opportunity, motivation, and metacognition. Consistent with previous survey research on metacognition, the metacognition factor was further divided into knowledge of cognition and regulation of cognition (Schraw and Dennison, 1994). The initial results of factor analysis showed a significant chi-squared test of model fit ($X^2(362, N = 66) = 572.07, p < .0001$). The root mean square error of approximation was 0.094 (p < .0001), which was a mediocre fit. The CFI (0.662) and TLI (0.621) were weak. Finally, the Standardized Root Mean Square Residual was also weak (0.103).

Due to the low sample size, standardized model results showed that few of the questions under each construct had estimates above the goal of 0.7, yet all but two of them had two-tailed p-values that were significant at the 90 percent confidence level. One question within the metacognition (regulation of cognition) construct had a very high p-
value (p=.601) so it was dropped from the model. Only one other question, within the motivation construct, had an insignificant p-value (p=.147), but it was retained in the model due to the small sample size and theoretical fit with the construct. Another question was removed from the student knowledge construct because it was not a good theoretical fit with the construct. Finally, one question on the divergent thinking construct and one question on the authoritarianism construct indicated strong, negative covariance with a modification index of 24.24. Given this result and the theoretical relationship between these questions—both asked about divergent thinking and authoritarianism—the model was modified to show this relationship.

Following the above modifications, root mean square error of approximation improved to 0.082 (p < .01). The CFI (0.819) and TLI (0.790) also improved, but remained weak. The Standardized Root Mean Square Residual also improved (0.098), though it remained weak. The new chi-squared test of model fit (X(302, N = 66) = 436.34, p < .0001) remained significant. Though many of these values are weak, the model featured more parameters than sample size, so these values are acceptable for the purposes of this needs assessment.

Confirmatory factor analysis was also conducted on the faculty survey, using factors for divergent thinking, authoritarianism, student knowledge, time and opportunity, motivation, and course structure. Overall, the model fit was poor with a root mean square error of approximation of 0.17 (p < .001). The CFI (.439 and TLI (.332) were weak. The chi-squared test of model fit (X(194, N=31) = 368.056, p < .001) was significant.

According to the standardized model results, all four of the student time and opportunity items were positively and significantly related to the factor (p < .1). Two of
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four items had estimates above the goal of 0.7. Additionally, all of the divergent thinking items were significantly (p < .05) related to the divergent thinking factor, but one was negatively related. This was the item that asked faculty if they place more emphasis on creativity than content in grading. Two of the five had estimates above 0.7. For the student knowledge factor, two of three items were significantly related to the factor (p < .01) while the third was not significant (p = .169). Only one of the items had an estimate above 0.7. Standardized results for the other factors showed that less than half of the items were significantly related to their hypothesized factors. Of note, the factor for student time and opportunity was significantly and positively related to the factors for divergent thinking (.622; p = .006) and student knowledge (.649; p = .041), and significantly and negatively related to the factor for authoritarianism (-.435; p = .041).

Conceptual Framework revisited

An analysis of covariance for each of the factors originally introduced in the conceptual framework shows significant covariance amongst several of the factors on the student survey. The factor for metacognition has been divided into its component parts (knowledge of cognition and regulation of cognition). The estimate and two-tailed p-value for each hypothesized relationship between factors is in figure 2.4. Many of the hypothesized relationships proved to be significant. The largest and most significant relationships included the relationship between divergent thinking and time and opportunity (positive) and divergent thinking and authoritarianism (negative).
Relationship between factors and creativity outcomes

Because some students provided their names, their survey data for each of the above factors could be compared to their first semester GPA, essay grades and QEP assessments (if they were in the CSC QEP sample). Using multiple linear regressions ($Y=b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7$), where $Y$ reflected the results on each of these assessments, Table 2.8 shows t-scores for each factor on each assessment. Because only 27 students provided their names, and only 16 of those students were in the QEP sample, it was difficult to establish significant relationships between these assessments of student learning and the results of the student survey, even at the 90% confidence level. Nevertheless, some useful information emerged.
Table 2.7: t-scores for each factor with grades and QEP assessments as dependent variables  
(n= 27 for 3100B, 4100B, GPA; n= 16 for QEP)

<table>
<thead>
<tr>
<th>Factor</th>
<th>3100B</th>
<th>4100B</th>
<th>GPA</th>
<th>QEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Divergent Thinking</td>
<td>-1.227</td>
<td>-0.375</td>
<td>-1.065</td>
<td>0.65</td>
</tr>
<tr>
<td>Authoritarianism</td>
<td>-1.488</td>
<td>-1.334</td>
<td>-1.735*</td>
<td>-2.085*</td>
</tr>
<tr>
<td>Student Knowledge</td>
<td>1.115</td>
<td>-0.567</td>
<td>0.936</td>
<td>-0.309</td>
</tr>
<tr>
<td>Time and Opportunity</td>
<td>-2.433**</td>
<td>-1.737*</td>
<td>-1.256</td>
<td>-1.762</td>
</tr>
<tr>
<td>Motivation</td>
<td>0.167</td>
<td>0.527</td>
<td>-0.553</td>
<td>-0.007</td>
</tr>
<tr>
<td>Metacognition (Knowledge of Cognition)</td>
<td>0.275</td>
<td>-0.753</td>
<td>-0.238</td>
<td>0.946</td>
</tr>
<tr>
<td>Metacognition (Regulation of Cognition)</td>
<td>-0.390</td>
<td>-0.648</td>
<td>-1.42</td>
<td>-2.324**</td>
</tr>
</tbody>
</table>

*p < .1; ** p < .05

The analysis in Table 2.7 shows some expected and unexpected results. See appendix D for the regression outputs associated with table 2.7. As expected, authoritarianism was significantly and negatively related to QEP scores. That this relationship extended to GPA was also an interesting finding. However, the negative relationship between time and opportunity and grades on the 3100B and 4100B essays was surprising and concerning. This result would seem to suggest that as students agreed more strongly that they had enough time to think creatively, they actually scored significantly worse on these essays. Similarly, as students reported higher scores on regulation of cognition, they scored significantly worse on the quality enhancement plan’s assessment of creativity. Moreover, there were no other significant effects of metacognition and no significant effects of divergent thinking on these assessment scores.

**Qualitative survey themes**

Both faculty and students had the opportunity to respond to optional open-ended questions at the end of the survey. The open-ended questions concerned barriers to creativity, bridging the potential divide between military hierarchy and divergent thinking, and strategies for creative thinking in professional military education. These questions are listed in Appendices B and C. A total of 43 students and 17 faculty
provided at least one response to an open-ended question. There was not a significant
difference in average responses for each factor discussed above between respondents who
provided open ended responses and those who did not.

A few key themes emerged from the qualitative analysis of the open-ended survey
response. The researcher conducted first cycle coding using emergent coding and second
cycle coding using thematic analysis (Saldaña, 2016). Thematic analysis resulted in 6
themes and 21 sub-themes. Table 2.8 lists these themes, sub-themes, and example codes
within each sub-theme.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub-themes</th>
<th>Example Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations</td>
<td>Organization</td>
<td>Vertical integration</td>
</tr>
<tr>
<td></td>
<td>Schedule</td>
<td>Flexibility</td>
</tr>
<tr>
<td></td>
<td>Content</td>
<td>Historical case studies</td>
</tr>
<tr>
<td></td>
<td>Context</td>
<td>Job applicability</td>
</tr>
<tr>
<td></td>
<td>Process</td>
<td>Teach creativity</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td>Depth of content</td>
</tr>
<tr>
<td>Divergence</td>
<td>Encouraging</td>
<td>Set the tone</td>
</tr>
<tr>
<td></td>
<td>Lack of</td>
<td>Words vs. actions</td>
</tr>
<tr>
<td></td>
<td>Safety to</td>
<td>Outcasts</td>
</tr>
<tr>
<td>Faculty</td>
<td>Authority</td>
<td>Close-mindedness</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td>Variation</td>
</tr>
<tr>
<td>Locus of problem</td>
<td>Faculty</td>
<td>Military faculty</td>
</tr>
<tr>
<td></td>
<td>Students</td>
<td>Student knowledge</td>
</tr>
<tr>
<td>Metacognition</td>
<td>Regulation of cognition</td>
<td>Planning learning</td>
</tr>
<tr>
<td></td>
<td>Thinking techniques</td>
<td>Red teaming</td>
</tr>
<tr>
<td>Time</td>
<td>To discuss</td>
<td>Coverage of readings</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>To read</td>
<td>Page requirement</td>
<td></td>
</tr>
<tr>
<td>To think</td>
<td>Busywork</td>
<td></td>
</tr>
<tr>
<td>To work</td>
<td>Requirements</td>
<td></td>
</tr>
<tr>
<td>To write</td>
<td>Structured writing time</td>
<td></td>
</tr>
<tr>
<td>Time management</td>
<td>Time dictates quality</td>
<td></td>
</tr>
</tbody>
</table>

**Time**

Time was the key theme for the open-ended survey responses for both faculty and students. Time to think and the amount of reading were the two most often mentioned codes for both faculty and students. The clear implication with both groups was that the amount of reading was too great and it impeded students’ ability to dedicate time to thinking. For instance, one student described the amount of reading required each day as “ridiculous,” while another student stated that “Students would benefit from less required reading per night…in order to provide time to adequately digest the subject matter and to facilitate critical thinking.”

Several of the faculty comments indicate agreement about lack of time to think, with one faculty member attributing the problem to thinking in the government world:

People need space and time to think divergently about topics. [CSC] takes the opposite approach; CSC believes that more activities, assignments, lectures, readings, etc. equals more rigor. That is absolutely not the case. Unfortunately, in the government world, there is a notion that if the time is not organized with some sort of activity, then employees must be goofing off. No --- we need time to read, write, and think about this stuff.
Especially in the faculty comments, there are complaints about the amount of time required for assignments, and not just for reading. Moreover, students indicate that they actively manage their time, putting more or less effort into each assignment, depending on the amount of time they feel that they have available to complete the assignment.

**Content**

Students and faculty also complain about the content of the curriculum. There are calls to reduce historical content and then other calls to increase the historical content. There are calls to focus the content of the courses on practical problems related to the military professional and other calls to diversify the curriculum to incorporate more lessons from the business world and other areas. Both faculty and students seem to agree that the curriculum should be more focused and have greater depth. For instance, one faculty member suggests that the curriculum should “move from covering the waterfront in what feels like a replay of college/BA/BS, purposefully focus on fewer but key themes to do a deeper dive.” Other faculty complain that some students do not “have sufficient academic preparation and/or command of written English to successfully complete a graduate-level program.” Ironically, however, there is little agreement about where to focus the curriculum. Moreover, students and faculty also call for a greater diversity of viewpoints in the readings at the same time as they call for fewer pages of reading.

**Authoritarianism vs. Divergent Thinking**

There are a wide variety of opinions about the environment for divergent thinking at CSC as well as the existence of authoritarianism that negatively impacts creativity. Some students and faculty speak highly of the academic freedom they have, while others decry the inability to discuss controversial topics in the seminar group. Furthermore,
when students report a problem with authoritarianism, they do not always agree on where the problem lies. Some students attribute the problem to military faculty members who do not understand the academic environment and seek only to indoctrinate students with their own views. Other students question the assumption that military hierarchy is the problem and instead point to civilian faculty as creating an environment that is hostile to different ways of thinking. Still other students attribute hostility to their fellow students, who might lack the “maturity” necessary to discuss controversial topics.

Two key suggestions for creating an environment of academic freedom, psychological safety, or divergent thinking emerged from the faculty and student surveys. First, several respondents suggested that students and faculty should not wear uniforms with rank during the seminar discussions. The argument is that some students will “self-edit” to avoid the risk of irritating senior officers and that the wearing of rank in the classroom is a constant reminder of seniority. One student, on the other hand, specifically stated that the removal of rank “is a childish and cowardly way to approach having open and professional discussions.”

The second key recommendation for encouraging divergent thinking emerged primarily from the faculty survey where faculty members recommended setting a tone early on in the year that respects divergent opinions. One way faculty recommend this is done is to praise students who raise divergent opinions and challenge the status quo while never “responding emotionally or defensively to a student who is trying to think critically.” Of course, doing this is difficult and some students complain that initial verbal support for divergent thinking does not translate into the actual classroom experience.
However, both students and faculty recognize that there is a difficult balance to maintain between respect for military authority and encouragement of outside the box thinking.

**Thinking**

Finally, the student survey asked students to give some examples of ways that they manage their thinking when they are solving problems. Here again time management was a key theme, with one student spelling out a long, sarcastic response about the process of developing ideas and then concluding that they really just “think about the problem for a bit, usually reference some things I've read or remember reading. Bounce some ideas off a couple people who are smarter than me. Sleep on it. Finalize the ideas in the shower and on my commute.”

In addition to the theme of time management, some students also mentioned specific thinking techniques like playing the devil’s advocate, cost-benefit analysis, crowd-sourcing, brainstorming, writing the problem down and returning to it later, or referring to specific structured analytical techniques. Students also mentioned that they plan how they are going to solve a problem, try to monitor their thinking as they are solving the problem, or seek feedback on their ideas. Specific sources of feedback include their fellow students, mentors, and faculty. Finally, more than one student mentioned taking time off to think about something else and then returning to the problem later.

**Discussion**

The research questions asked about faculty and student perceptions of factors related to creative thinking. They also asked how students’ perception of these factors related to their performance on assessments designed to encourage creative problem
solving. Additionally, this needs assessment aimed to identify how faculty and students describe the environment for creative problem solving at MCU. This discussion will consolidate findings for each of the factors across the various data sources.

**Divergent Thinking**

The quantitative results show that students and faculty generally had a high view of divergent thinking at CSC, and divergent thinking was significantly and negatively correlated to authoritarianism on the student surveys. Given the opportunity, some students were highly complementary of specific faculty members. At the same time, open-ended responses tended to focus on problems. However, the locus of the problem was often not necessarily the faculty. Moreover, problems and attitudes toward divergent thinking and creativity in general often varied by the individual faculty member, such that some faculty were perceived to be exceptionally good and others were perceived to be exceptionally bad.

Furthermore, opinions about student divergent thinking often varied by faculty member. For instance, the fact that faculty opinions of student creativity tended to decrease when students were working in that faculty member’s area of expertise is an important finding. Additionally, students sometimes reported a lack of standardization in grading or that grading did not reward creativity. Disappointingly, divergent thinking was not a significant predictive factor for scores or grades on any of the assessments or on GPA. Perhaps this is partially explained by the fact that divergent thinking ratings were so high on the scale and had low variability.
Authoritarianism

As with divergent thinking, student perceptions about authoritarianism were highly faculty dependent. Meanwhile, faculty and students both generally recognized the need to balance military hierarchy with psychological safety in the classroom, to greater or lesser degrees of success. The fact that authoritarianism and divergent thinking were significantly and negatively correlated on the student surveys suggests that any intervention aimed at increasing creativity should consider the relationship between divergent thinking and authoritarianism. In addition to being significantly and negatively related to divergent thinking on the student surveys, authoritarianism was also significantly and negatively correlated to GPA and the practical assessment of creative thinking at the staff ride at Chancellorsville battlefield.

Student Knowledge

Aside from a few negative comments about select students, faculty and students both had a relatively high opinion of student knowledge. Students and faculty both generally felt that student knowledge of research methodology was high even though a review of the student theses shows that students did not often use empirical research methodology. Additionally, some students and faculty wanted to allow for deeper dives into various content areas, sometimes to increase student knowledge as a foundation for creative thinking and sometimes to allow students to examine topics of greater interest to them.

Time and Opportunity

The most important finding in all of the qualitative data as well as the descriptive quantitative data is that there is a perception that students do not have enough time to
think creatively. Many respondents, especially students, attributed this lack of time to an overwhelming amount of reading or other work required to ensure students have good content knowledge. Given that student knowledge seems to meet expectations, one might conclude—as many respondents did—that the amount of reading could be reduced. At the same time, perhaps a reduction in the amount of reading might reduce student knowledge to unacceptable levels. Similarly, for both faculty and student surveys, the factor for time and opportunity was significantly and positively correlated to the factor for divergent thinking.

The perception that students do not have enough time to think does not bear out in the analysis of scores on the artifacts examined for creativity. In fact, confusingly, scores for each of the analytic essays examined were significantly and negatively related to the factor of time and opportunity on the student survey. This indicates that students who thought they did not have enough time to think scored higher than those who thought they did have enough time. Perhaps this rules out the perception that students who perform poorly use lack of time as an excuse. On the contrary, it seems that the students who perform the best also perceive that they do not have enough time, potentially suggesting that they are putting extra effort into the work. Thus, the relationship between time and opportunity and divergent thinking deserves further examination.

**Motivation**

Motivation was not an important theme of the qualitative results as neither students nor faculty mentioned it. Moreover, though student motivation was significantly and positively correlated to divergent thinking and knowledge of cognition on the student surveys, regulation of cognition was not significantly correlated with motivation. These
results suggest that student motivation is not one of the most important factors for creativity in this context.

**Metacognition**

Faculty were not specifically asked about student metacognition and the idea did not emerge as a theme from the faculty qualitative survey results. Students were asked about metacognition and they had a very high degree of confidence in their metacognitive ability. The survey had two sub-factors, knowledge of cognition and regulation of cognition, both of which returned high scores on the student survey. Oddly, one factor (knowledge of cognition) was significantly and negatively correlated to divergent thinking while regulation of cognition was not significantly related to time, motivation or divergent thinking. Oddly, one factor (regulation of cognition) was significantly and negatively related to scores on the evaluation of creativity in the practical exercise at Chancellorsville. It was not significantly related to any of the other assessments or GPA. As with the confusing results related to time and opportunity, this result was also confusing in that it suggests that high regulation of cognition led to a lower creativity score. However, the items used to identify these factors were only a small sub-set of the items from the larger Metacognitive Awareness Inventory (MAI) (Schraw & Dennison, 1994). The larger MAI was not used for this research due to its size and the time required to complete the survey. Perhaps a deeper analysis using the full MAI might return different results.

When asked to describe tactics they used to solve problems, students often described methods for regulating their cognition, especially in preparation and during the process of problem-solving. However, they were also clear that time dictated how much
planning and monitoring they could support. Given the above findings related to time, it seems that these two factors might go hand in hand. Perhaps giving students time to think might be insufficient to increase their creativity. Possibly students also need support to use that time well. Likewise, perhaps students do have good metacognitive ability but do not have time to exercise it. Indeed, one student complained that they did not get the prompts for the Chancellorsville exercise in time to prepare a good response. As with the factor related to time and opportunity, there is room for a more thorough examination of the relationship between metacognition, divergent thinking, and creative problem-solving at MCU.

Limitations

Two major limitations should be noted for this assessment. Of greatest importance, the sample sizes for the student survey (N = 66) and faculty survey (N = 31) were low, raising the possibility of type 2 error because of the low power of the sample. In order to mitigate this concern, significance was set at p < .1 rather than the common p < .05 standard, but this increases the possibility of type 1 error.

Secondly, the fact that this study used data primarily from the COVID-influenced academic years 2020-2021 and 2021-2022 might have an unknown effect on the overall data, making these academic years less likely to be generalizable to non-COVID influenced years. Most secondary data requested was from the 2020-2021 academic year and the data from researcher-developed surveys and interviews came from the 2021-2022 academic year. In both academic years, students mostly continued to meet in person with some events (e.g., lectures in 2020-2021) moved into a virtual format. Additionally, some field trips were restricted in 2020-2021 and students and faculty were periodically
required to meet virtually in seminar due to COVID-exposure. COVID-19 also may have had unknown psychological or emotional impacts, which might have influenced student learning and creativity.

**Conclusion**

This needs assessment discovered some important facts about the environment for creative problem solving at CSC. Students and faculty generally perceived divergent thinking to be high and authoritarianism to be low. However, it was unclear how divergent thinking related to assessments of creative problem solving. Additionally, some of the qualitative data show that perceptions of authoritarianism are highly dependent upon individual faculty members.

The perception that time was not sufficient for creative problem solving was the single most widely shared finding in the qualitative data and the descriptive quantitative data. However, the relationship between student assessment data and perceptions that there was not enough time for creative problem solving was ambiguous or even sometimes significantly and negatively related. Perhaps students who feel that they do not have enough time are also the students who are putting forth the most effort. Their grades reflect their effort, even though they would have liked to have more time to think creatively.

Similarly, the findings concerning metacognition deviated from the expected. Though students generally perceived their metacognition to be high, the metacognition scores were ambiguously related to student assessment results. Additionally, metacognition scores were not related to perceptions of time and opportunity. For future
work, the relationship between metacognition and time and opportunity deserves more inquiry with a more robust metacognition measure.
CHAPTER 3: INTERVENTION LITERATURE REVIEW

In 2020, the Marine Corps released a new “doctrinal” publication called Marine Corps Doctrinal Publication 7, Learning, designed to be the foundational framework for Marine learning. The authors state that, “Marines need time to reflect on new learning experiences to exploit their lessons. Self-reflection internalizes experiences and increases mental preparedness for employment across the range of military operations” (United States Marine Corps, 2020b, p. 3-15). However, in the world of military professional education, the amount of time for reflection and rumination is potentially not as bountiful as it needs to be (Johnson-Freese & Kelley, 2017). For instance, students at the Marine Corps CSC complete 39-42 credits in one 10-month academic year (MCU, 2021b). One question that emerges from this analysis is whether merely removing requirements from the curriculum (i.e., the amount of required reading or the number of required credits) is sufficient to facilitate reflection or if MCU should build structured time for reflection into the course schedule.

The needs assessment in chapter two drew on student and faculty surveys, including open-ended response options as well as secondary data analysis of student products and the annual student survey. A major theme that emerged from the open-ended survey responses of both faculty and students was that students needed more time to think. Moreover, the factor for time in the quantitative survey results confirmed that students and faculty agreed that students did not have enough time to think creatively about course content and their individual research. Moreover, students raised concerns in each of these surveys related to the importance of time for fostering creative thinking in scenario-based training.
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Time to Think

If time to think is critically related to creative problem solving, does any kind of thinking suffice or should faculty help to organize student thinking in some way? Some have claimed that creative problem-solving emerges when people are given the opportunity for unstructured thinking or mind-wandering (Johnson, 2011). Perhaps merely giving students more free time might encourage creative problem solving. On the other hand, research indicates that mind wandering is a less effective way of encouraging transformative thinking than providing structured prompts to aid thinking (Fink et al., 2007; Hao et al., 2016; Kudesia et al., 2015). See Appendix E for a summary of the most relevant studies that link metacognition with creativity or related concepts.

Fink and colleagues (2007) reported on a series of studies and found that alpha synchronization—a decrease in the oscillation of the alpha frequency on an EEG—was connected to creative thinking. Whereas alpha synchronization was previously thought to be associated with idling or inactivity, Fink and colleagues (2007) speculated that it might be associated with top-down control or the elimination of distractions in order to concentrate, especially on creative tasks. If alpha synchronization is merely inactivity, then mind wandering or mere free time might relate to enhanced creativity, but if alpha synchronization is associated with top-down control, then helping students to control their thinking, via reflective prompts, might be a useful strategy for encouraging creativity.

In a follow-up study, Hao and colleagues (2016) found that creative tasks were associated with higher alpha synchronization than word processing tasks and that asking participants to reflect on the quality and creativity of their ideas was correlated with
greater creativity in a second round of ideation and with higher levels of alpha synchronization. One must note that the experiment was conducted with Chinese undergraduate students in a lab, using very short (less than two minute) cycles of reflection or distraction, and ideation (Hao et al., 2016). Moreover, these studies used the alternative uses task, which asks participants to generate ideas about how an object might be used, so it is far from the type of detailed, sustained creative problem solving that MCU desires to build in its students, but this series of studies suggests a brain basis for the idea that prompting reflection leads to creativity (Hao et al., 2016).

Along these lines, Kudesia and colleagues (2015) found that mindful metacognition, rather than merely mind-wandering, led to better performance on creative thinking tasks posed to undergraduate students. The researchers theorize that mind-wandering leads to local search—the ability to find solutions related to initial ideas—while mindful metacognition leads to distant search—the ability to find solutions that are fundamentally different than the initial idea (Kudesia et al., 2015). In one study, after spending two minutes working on coming up with uses for a brick, three groups listened to audio prompts at a computer for ten minutes, with one set of prompts designed to induce mind wandering, one to cause students to focus on a task, and another to monitor their own thinking from an imagined far away vantage point (Kudesia et al., 2015). Following the ten-minute intervention, each group returned to the task of identifying uses for a brick, with the mind-wandering and mindful metacognition groups both finding significantly more uses for the brick than the focused-task group (Kudesia et al., 2015). Most interestingly, however, the mindful metacognition group found significantly more categorically different uses for a brick than did participants in the mind-wandering group.
(Kudesia et al., 2015). Similarly, in a related study, when researchers posed two trick questions to groups of students in mind-wandering or mindful meditation interventions, the students who experienced the mindful meditation intervention were significantly more likely to correctly solve the questions than those in the mind-wandering intervention (Kudesia et al., 2015).

**Metacognition and Structured Reflection**

If providing structure for student reflection is a potential key to increasing creative problem solving, what should be the guiding principle for this reflection? One potential answer is reflection to foster student metacognitive ability. The literature review in chapter two established the importance of metacognition for critical and creative thinking (Bruning et al., 2011; Chua et al., 2012; Ku & Ho, 2010). The literature review also explored how metacognition might improve a military officer’s creative thinking ability (Khachadoorian et al., 2020).

Flavell (1979) characterized metacognition as cognitive monitoring and control, especially important during novel and consequential situations. As such, metacognition would seem to be very important to Marines where “The most important six inches on the battlefield is between your ears” (Mattis, 2013, p. A-24). Following Flavell, Schraw and Dennison (1994) created the Metacognitive Awareness Inventory, with two factors: knowledge of cognition and regulation of cognition. Knowledge of cognition refers to a learners’ ability to understand their own or others’ cognitive processes, including their cognitive strengths and weaknesses (Cantwell et al., 2017; Schraw & Moshman, 1995). Regulation of cognition refers to control over the thinking process, including planning learning or creative activity, monitoring one’s thinking and learning, and evaluating one’s
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learning or creation (Schraw & Moshman, 1995). Macias (2021) argues that the U.S. Marine Corps ought to include more metacognitive instruction in professional military education. Macias's (2021) definition of metacognition is more expansive than the above definition, but he points to reflection as the first stage in a cycle moving from critical thinking to complexity theory, creativity, communication strategy, and change management. Macias (2021) does not actually detail the results of an intervention, but he makes the argument that metacognition is essential to problem solving in the increasingly complex operational environments in which Marines might find themselves this century.

Importantly, the Marine Corps desires that any gains in metacognitive ability are associated with gains in other outcomes, including measures of battlefield success as well as the ability to solve problems creatively. Several studies have shown that schools can improve the creativity of their students by focusing on the skills and processes related to creativity (Grant & Smith, 2018; Gregory et al., 2013; Katz-Buonincontro et al., 2017; Reid & Anderson, 2012). Moreover, metacognition helps thinkers overcome cognitive biases and other barriers to creative thinking (Mumford & Gustafson, 2012). Metacognition increases critical thinking ability and helps students examine their thinking in order to approach problems from a different viewpoint (Bruning et al., 2011; Chua et al., 2012; Ku & Ho, 2010). Finally, reflection, which metacognition helps facilitate, is the means by which students generate new ideas and avoid repeating the same mistakes over again (Hao et al., 2016; Mumford & Gustafson; 2012).

**Scenario-Based Training and Metacognition**

Scenario-based training is especially important to the Marine Corps and MCU because artificial scenarios approximate the conditions of war and help determine what
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leads to victory—the ultimate outcome of concern for United States military training. Wargaming is the primary method of scenario-based training that the University employs, and the Commandant of the Marine Corps has recently called for an increase in the amount of wargaming in Marine Corps training and education (Berger, 2019). As defined in Wong, et al. (2019), “A wargame involves human players or actors making decisions in an artificial contest environment and then living with the consequences of their actions. Games consist of actors who make decisions, an environment they seek to effect, rules that govern what decisions they can make, and adjudication models that specify how actions affect both actors and the environment” (p. 5).

The University uses both table top and computer-based wargames (Gordon, et al., 2020; Jensen, 2019; Lacey, 2016). Many respondents, in open ended responses, also highlighted the importance of designing assignments and scenario-based training to allow for creative solutions, rather than merely encouraging students to complete briefing products from templates as quickly as possible. Again, these factors are related. The impact of time constraints is, according to many students who provided comments, negatively related to creativity, yet limited time is sometimes a realistic constraint.

Given the importance of scenario-based training to the Marine Corps training and education enterprise, examining ways the University might incorporate metacognition into scenario-based training interventions seems appropriate. Some of these interventions involve computer-based scenarios and automated feedback while others employ human gameplay adjudicators. The idea of game-based learning and artificial intelligence is not new to MCU, but the University’s efforts in assessment of game-based learning are in their infancy (Gordon, et al., 2020; Jensen, 2019; Lacey, 2016).
The research around metacognitive interventions shows mixed results and scenario-based training interventions are no different. For instance, Lloret and colleagues (2003) describe one early attempt at using computer-based applications to incorporate self-regulated learning into graduate dental education. In this case, students were asked to create materials in a computer program that would help them on an epidemiology exam (Lloret et al., 2003). After completing a pre-test in the subject matter and a measure of metacognition, students received 12 weeks of instruction in epidemiology and about metacognition, motivation and other cognitive processes coupled with the use of Macromedia Flash to learn about epidemiology (Lloret et al., 2003). At the end of the 12 weeks, the participants created content-based material on their computers while “thinking aloud” about the metacognitive processes they used in developing the material (Lloret et al., 2003). The researchers found that the students improved their epidemiology knowledge, but there was no control group to determine if the improvement in epidemiology knowledge was related to metacognition (Lloret et al., 2003). In fact, they found that quantitative measures of metacognition showed a significant decrease in the use of metacognitive strategies from the pretest to the posttest (Lloret et al., 2003). At the same time, using qualitative analysis, the researchers concluded that students used self-assessment of learning strategies as a result of the intervention (Lloret, et al., 2003). Lloret and colleagues (2003) concluded that comfort with the use of the Macromedia Flash program might have been an issue for some students. Conversely, Yeh and colleagues (2020) found that comfort with the use of technology—in this case, smartphones—was significantly related to creativity in a smartphone-based mindfulness intervention. This intervention, which was not specifically...
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tailored to metacognition, conceived of mindfulness as including both cognitive and emotional self-regulation, which is arguably related to metacognition (Yeh et al., 2020). The researchers found that smartphone-based mindfulness interventions for 149 undergraduate students in Taiwan helped to enhance their creativity and that their perception of the usefulness of smartphones for learning about creativity mediated the relationship between the intervention and increased creativity (Yeh et al, 2020).

Within the realm of military scenario-based and computer-based training, Vogel-Walcutt and colleagues (2009) used a scenario-based training event and then a scenario-based assessment event to teach metacognitive skills in a fast-paced fire support mission. Fire support is the act of calling over the radio for air or artillery support to engage enemy positions. The observer estimates the location of the enemy and then passes that location on to the supporting unit, who fires the missiles, rounds, etc. In this scenario, participants were college students mostly without military experience who used a military simulator to learn to call for fire support (Vogel-Walcutt et al., 2009). Following basic training in fire support. The researchers divided the students into control and metacognitive intervention groups with the metacognition intervention group experiencing metacognitive prompts while in training practice, but not in the assessment (Vogel-Walcutt et al., 2009). The metacognitive prompts involved students recalling rules that they learned in their basic training and describing how the rules applied to the situation in the scenario (Vogel-Walcutt et al., 2009).

The researchers found that the rule-comprehension metacognitive group increased its metacognitive knowledge and skill as a result of the training. Additionally, when comparing the metacognitive group and a control group, they found that, although the
metacognitive group had increased cognitive load during training, they had decreased cognitive load in the assessment (Vogel-Walcutt et al., 2009). So, it appears that having the metacognitive prompts in the training practice led to a decrease in cognitive load during the actual assessment. In that way, one might consider the training a success, but the researchers also found no significant difference in the ability of either group to hit enemy targets and found that the rule-comprehension metacognitive group accidently hit significantly more friendly targets (Vogel-Walcutt et al., 2009). The researchers admit their disappointment with this last finding, but state that they could not determine if the increased friendly fire was due to the rule-comprehension metacognitive prompts interfering with learning or might be explained by other factors like a lack of familiarity with fire support or the training system (Vogel-Walcutt et al., 2009).

Another series of articles represents a more detailed metacognitive scenario-based training invention. Developed for the Canadian military, a scenario-based intervention called CODEM was specifically designed to increase participants' complex decision-making skills and to help them learn to think about and avoid unintended consequences of military action (Lafond et al., 2012a). The researchers argued that metacognition is one of five main components of good decision-making skill, and designed their scenarios to provide participants with the opportunity to learn metacognitive skills from an artificial intelligence tutor (Lafond et al., 2012a). The tutor provides feedback on the extent to which participants sought out important information and engaged in various decision-making patterns in each scenario (Lafond et al., 2012a). Participants also rated their own performance and the tutor used their ratings to provide feedback on how well they understood their performance. The authors report that they will be continuing to assess
the impact of the scenario-based training on complex decision-making skills and examining ways to incorporate human instructor feedback into the process as some of the participants were skeptical of the artificial intelligence tutor’s feedback (Lafond et al., 2012a).

According to personal correspondence with one of the above authors, the researchers were unable to confirm an effect of the training with respect to “complex decision-making techniques” (Rathbun, 2021, personal communication). However, two other studies report some useful findings, though neither of these follow-up studies reported on the results of the metacognitive component of complex decision making. Lafond and colleagues (2012b) report that the researchers used the CODEM simulation to determine how training on systems thinking and collaborative design helped students to solve complex problems requiring collaborative military-civilian approaches. They found that the students who received the training performed better in the category of integrative planning effectiveness than those who did not, though they still found that all students experienced difficulty with the complexity of the scenario. Moreover, Gagnon and colleagues (2012), using the CODEM simulation, found that success in the simulation was correlated to seeking situational awareness in the first turn and that participants who spent more time assessing outcome feedback in subsequent turns also significantly increased their success. Though the researchers did not report on the metacognitive measures for these follow-on studies, arguably these two information-seeking behaviors indicate greater metacognitive awareness in that participants were actively reflecting on what they knew and what they needed to learn.
Finally, a study involving Norwegian cyber engineering undergraduate military cadets sought to examine how self-regulation and metacognitive awareness were related to cognitive agility during a cyber-defense exercise (Knox et al., 2019). The researchers gave participants a series of pre-tests designed to measure their metacognition awareness and control, the extent to which they ponder instead of brood over decisions, and their self-regulation (Knox et al., 2019). The pretests included a response style questionnaire, the Metacognitive Awareness Inventory and a self-regulation questionnaire (Knox et al., 2019). The researchers created an $x,y$ graph with the different elements of the exercise (strategic, tactical, physical, cyberspace) assigned to each axis of the graph (Knox et al., 2019). Each hour of each day of the four-day exercise, the students marked where their current thinking was concentrated (Knox et al., 2019).

In the above study, the researchers interpreted movement around the graph to be an indication of cognitive agility and found that metacognition, self-regulation, and pondering were all significantly associated with this cognitive agility (Knox, et al., 2019). The problem of practice for the current study asks how to improve military students’ creative problem solving. Is cognitive agility, as described in this study, related to creativity? Arguably, cognitive agility is related to problem solving in that flexibility in one’s approach to a problem helps one to see the problem through different lenses, leading to the potential for solutions that take advantage of new connections and diverse perspectives.

**Classroom-based interventions**

Within the military or graduate school context, what are some curricular interventions that might increase both metacognition and creativity? Interventions might
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include teaching military students about metacognition, as both MCU and Air University have recently started to do (Khachadoorian et al., 2020). Miller and colleagues (2021) argue that “Learning requires more than telling people to ‘reflect’ and hoping for the best” (p. 73). They report the design of an intervention involving intermediate-level leadership education in the Coast Guard that involves daily guided reflection of 30-60 minutes; reflection is organized around four major categories: content, metacognition, self-authorship, and transformative learning (Miller et al., 2021). Additionally, Miller and colleagues (2022) report that they are developing a measure, in coordination with the U.S. Naval War College and the U.S. Military Academy to measure the effectiveness of similar guided reflection activities.

In a civilian university context, Pelton (2019) designed a knowledge-based intervention that asked if teaching about metacognition and metacognitive strategies would lead to students using metacognitive strategies more and increase their motivation and confidence. The study, which involved sociology students who were mostly undergraduate students, employed a pre- and posttest methodology using the Motivated Strategies for Learning Questionnaire (Pelton, 2019). Pelton (2019) found that students exhibited significantly greater metacognitive strategy use after the course, but that there was no significant difference between students in the treatment group and students in the control group. Additionally, there was no significant difference in confidence or motivation between treatment and control. Moreover, Pelton (2019) found no significant difference in student achievement of course outcomes between intervention and control groups, but made clear that the course outcomes in question are influenced by more
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factors than merely whether or not students grasped the sociological theory presented in the course.

Another study looked specifically at Ph.D. students in Australia and grouped them into three clusters, based on measures of metacognitive ability using the Metacognitive Awareness Inventory and other measures (Cantwell et al., 2017). These researchers found that one cluster was constructively engaged, the second was struggling to engage, and the third was disengaged (Cantwell et al., 2017). Structure of knowledge, need for cognition, and doctoral efficacy were the three main constructs for the constructively engaged cluster. The authors do not point to knowledge of cognition as a main construct for any cluster, but it could have been a fourth distinguishing mark for the constructively engaged cluster (based on the graph provided). The struggling to engage cluster is also somewhat high on the knowledge of cognition indicator, but is distinguished in part by higher scores in regulation of cognition. The disengaged cluster is very low on this measure.

Interestingly, there was no evidence that membership in the first cluster increases as years of candidacy increase, but there was evidence that students move from the second cluster to the third (Cantwell et al., 2017). The authors make the case for individualized interventions based on the profile of the learners, and they argue that accepting the complexity of knowledge is key to membership in the first cluster, so ought to be a focus of interventions for those in the second and third clusters (Cantwell et al., 2017).

Within the military context, the highest level of professional military education is called top-level school or senior-level education. Students at this level generally have around 20 years of experience as military officers and have a record of consistently superior performance in the face of increasing leadership responsibility. Though these
students generally only earn one-year residential master’s degrees, they can be compared to doctoral students in that they are in many ways elite officers. For instance, students at this level are selected for their potential for promotion to general or admiral (Joint Chiefs of Staff, 2020). Marshall-Mies and colleagues (2000) developed a metacognition measurement system for these senior-level military officers, based on complex scenarios designed to simulate real-world military operations. Within their context at National Defense University, a top-level school, they found that high scores on metacognitive process and solution construction correlated with better performance in the course (Marshall-Mies et al., 2000). Additionally, they found that their measure for planning and implementation was positively correlated to their metacognitive process measure, but they did not report any significant relationship from planning and implementation to performance in their courses. They suggested a pre- and posttest format for assessment of senior-level military education at National Defense University and similar military institutions. Their findings seem to support those of Cantwell and colleagues (2017), but no empirical follow-up report of an intervention along the lines that Marshall-Mies (2000) and colleagues suggested has been found.

Cognitive flexibility might also be a key to creative problem solving, though it is anecdotally not normally associated with military officers. Zwald and colleagues (2022) report a study conducted across multiple professional military institutions at the intermediate and top-level. Students received a series of vignettes about deterrence in ambiguous situations and the researchers asked them to choose amongst two courses of action and to explain their choice (Zwald et al., 2022). The researchers categorized their explanations of their choices as realist, idealist or moral and posited that individuals
should show flexibility in their explanations across the vignettes, indicating that they were able to employ a diverse set of concepts to explain their choices (Zwald et al., 2022). However, the researchers found a lack of flexibility and concluded that “Judgments that result from inflexible theory-driven thinking tend to narrowly interpret some portion of the information available, disregard seemingly contradictory information, and dismiss interpretations of information that proceed from different operative theories” (Zwald et al., 2022, p. 46-47).

Importantly, Zwald and colleagues (2022) found no significant differences by service in the proportion of explanations that were realist, idealist or moral. They conclude that working in teams with others who think in different ways was important and that being self-aware about the theory driving one’s decision was also important (Zwald et al., 2022). Thus, they recommended that military officers learn to be self-aware—arguably, increase their knowledge of cognition—and work in teams, especially teams incorporating civilians (Zwald et al., 2022). Similarly, Freier and colleagues (2020) reported positive feedback and useful outcomes for a project at Army War College (top-level school) that used student-faculty teams to cooperatively research questions of strategic interest to the Army. Each of these examples point to the importance of peer collaboration. Peer collaboration and peer review can be an important factor in improving student metacognition (Santelmann et al., 2018).

Arguably, interventions at top-level schools might come too late for significant change throughout an officer’s career. On the other hand, an intervention early in one’s military education might have more of an effect precisely because it has the potential to influence the whole of an officer’s career. One such intervention involved 112
undergraduate engineering students at the US Military Academy (Shay et al., 2019). These students were participants in a long-standing capstone engineering course that required them to work in teams to develop autonomous ground vehicles (Shay et al., 2019). As part of the re-imagined capstone course, students were given multiple formal opportunities to engage in reflection on their performance as individuals and teams, and also to reflect on the performance of other teams (Shay et al., 2019). The researchers found that the intervention was successful in multiple ways. They found that students completed work in a more paced manner, rather than last minute, that teams were more cohesive, and that students were more engaged with their projects, as demonstrated by a significant increase in the number of student-authored publications related to their engineering projects (Shay et al., 2019). Finally, they found an increase in the number of external awards students received (Shay et al., 2019).

**Phases of Metacognitive Regulation**

Metacognition is divisible into two factors: knowledge of cognition and regulation of cognition (Schraw & Dennison, 1994). Within the regulation of cognition factor, three sub-factors exist: planning, monitoring, and evaluating (Schraw & Moshman, 1995). These factors might be organized according to timing (before learning, during learning, and after learning). Though Schraw and Dennison did not find strong support for these sub-factors in their original factor analysis of the Metacognitive Awareness Inventory, Balcikanli (2011) did find these factors in a modification of the Metacognitive Awareness Inventory for Teachers (more on these measures in the next chapter).

Monitoring learning is the phase of metacognitive regulation that occurs while the learning is happening. Schraw and Moshman (1995) report that monitoring can be
improved with practice and that the ability to monitor how well one understands a passage when reading is related to performance on a post-reading test. However, distinguishing between monitoring and the other phases can be difficult. Carson (2012) reports the results of an intervention with Japanese University students who were English majors, finding that students monitored and planned next steps for learning throughout the session, not merely at the beginning or the end. Often learners moved back and forth from thinking about the content to monitoring and planning learning, so Carson (2012) concludes that metacognition is vital to independent learning, like writing a thesis, and that advisors should engage students in metacognitive activities throughout each stage of the project.

Planning and evaluating one’s learning—rather than only monitoring—are also important elements of metacognitive regulation and control. Planning, like monitoring, can be improved over time; for instance, older writers plan their writing generally, rather than specifically, and can plan their writing well regardless of content (Schraw & Moshman, 1995). Similarly, good writers are better at evaluating their writing by diagnosing flaws in their own writing and fixing them (Schraw & Moshman, 1995). Wagener (2016) had students—French psychology undergraduates—write plans to increase their understanding of course content. They also took quizzes on content and rated how they thought they did on those quizzes immediately after taking them and rated their learning comprehension at the end of each class (evaluating learning). In the end, students in the intervention group performed significantly better than students in the control on the end of course comprehensive exam (but not on the mid-course exam) (Wagener, 2016).
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On the other hand, Townsend and Liu (2012) found that planning can have a negative impact on self-control (healthy eating) when the individual doing the planning recognizes that they are behind or not keeping up with the plan, creating emotional distress and leading to a loss of motivation. They recommend ensuring that self-criticism remains at the task level and not at the level of global self-esteem, and they recommend breaking goals down into smaller, more manageable parts (Townsend & Liu, 2012). This suggests that in a different context—academics—the role of the advisor in monitoring student progress is extremely important, both in ensuring the student remains on task, but also in helping the student not to become overly self-critical or emotionally overwhelmed by their relative progress toward the final goal (Townsend & Lui, 2012).

Conclusion

The evidence discussed in this chapter suggests that metacognition-related interventions can significantly influence student performance in higher education from undergraduate to doctoral contexts. Additionally, metacognition-focused interventions can improve outcomes in military training exercises and on overall military performance. Some of these interventions focus specifically on creative problem solving, while others focus on other measures of success in simulated combat or in the classroom. However, not all metacognition-focused interventions are successful. Some interventions lead to greater metacognitive ability without corresponding improvements to creativity or other outcomes. This fact points to two important elements of any future metacognition-focused intervention in the military or higher education context. First, the design and quality of the intervention matters because some interventions might involve more effort than is justified by the effect. Secondly, assessing the impact of any intervention, rather
than assuming that it is effective, is important. The fact of the mixed results of interventions, as detailed here, drives home the requirement that any future intervention be subject to robust assessment in order to avoid perpetuating unfruitful effort.
CHAPTER 4: INTERVENTION AND STUDY DESIGN

In 2020, as part of MCU’s strategic planning cycle, faculty and staff were asked to describe what they would like to see MCU do differently by 2030. Faculty and staff provided initial input, which was then categorized by topic. Increasing the cognitive and metacognitive ability of students was one of five major categories that emerged (Mackenzie, 2021). In early 2021, a working group consisting of faculty and staff from across the University was established to address this concern and craft recommendations for the President of MCU. The present author was a member of this working group. The group’s recommendations underscored the multiple levels of service and departmental guidance emphasizing the importance of cognitive and metacognitive skills for service members (Mackenzie, 2021). Ultimately, MCU enshrined the task of improving student metacognition into its strategic plan for academic years 2022-2027 (MCU, 2022b). To support the plan, CSC became the focus for the initial pilot metacognition intervention. The present study was designed to evaluate the intervention at CSC in order to make recommendations for other units of the University.

Elements of Design

The four elements of quasi-experimental research design are assignment, measurement, comparison groups, and treatment (Shadish et al., 2002). This study employs a quasi-experimental design with pre- and posttest and an untreated control group, using the cohort control method of comparison (Shadish et al., 2002). Additionally, this study is a mixed methods explanatory research design in that quantitative data is gathered first and qualitative data is used to help explain the quantitative results (Creswell & Plano-Clark, 2018).
Because College leadership wanted all students to receive the treatment in the 2022-2023 school year, assignment to the treatment group was not random (Shadish et al., 2002). One way to mitigate for a lack of randomized assignment is to choose comparison groups that have relatively minor differences (Shadish et al., 2002). Using subsequent year cohorts as comparison groups is another way to attempt to ensure that treatment and control groups are similar. Of course, cohort controls are subject to factors related to historical differences in the learning environment (Shadish et al., 2002). In this case, these historical differences include differences in COVID mitigation measures. However, selection and assignment to the College were conducted by independent groups and were substantially similar across cohort years.

The pre- and posttest design of the study allows for testing of the assumption that the treatment and control groups were similar before treatment began (Shadish et al., 2002). Moreover, the pre- and posttest design allows for standardization of scores, using the pretest as the means of standardization. The pretest for the control cohort and the treatment group were both conducted at roughly the same time in the respective academic years, with the control cohort’s results maintained in University files. Primarily because of the cohort control model, treatment strategies like switching replications or reversed treatments were not feasible (Shadish et al., 2002).

Theory of Treatment

This theory of treatment uses a causal diagram that shows the relationship between the elements of the intervention and the designed final outcome (Leviton & Lipsey, 2007). See figure 4.1 for the theory of treatment for this study. The theory of treatment forms the logical basis to make claims of causation concerning the effect of the
treatment on the outcomes (Leviton & Lipsey, 2007). One limitation of this logic model is the separation of each line of effort. In fact, each of the short-term outputs could be related to each of the intermediate outcomes.

Figure 4.1: Theory of Treatment

The intervention for this study had two major components. First, students were given more time to think. Specifically, during the 2022-2023 academic year at CSC, the amount of reading and other preparation work (e.g., watching videos) required prior to each seminar discussion was reduced by one hour. Practically speaking, considering an example in which only readings (and not videos or podcasts) were assigned, the students read roughly 60 pages instead of 80. However, rather than only giving students more free time, students were provided with reflective questions to ponder in conjunction with each seminar’s daily lesson card.

Time to think is a key ingredient to creativity in higher education and other contexts (Alencar & Fleith, 2010, 2014; Mumford & Gustafson, 2012). Similarly,
quantitative analysis from the needs assessment showed that the perception that students have enough time to think is positively and significantly related to divergent thinking. However, some studies have shown that structured reflection is more creatively productive than unstructured thinking or daydreaming (Knox et al., 2019; Kudesia et al., 2015; Marshall-Mies et al., 2000).

The reflective questions discussed above, designed to improve student metacognitive ability, are the second major element of the intervention. As above, they were assigned in preparation for each seminar, but they were also designed to be addressed in seminar discussion. Reflective questions were categorized as basic metacognition, thinking back to prior learning, thinking broadly about connections to the student’s research, thinking across courses, and thinking ahead to application of learning in one’s future classes or career (see figure 4.2).

Figure 4.2: Structured Reflection Categories

These categories were created by the MCU faculty council chair, a member of the faculty at CSC, in consultation with the author of the present study. Example prompts for
each category can be found in table 4.1. These examples come from lesson plans created by faculty in the leadership department.

**Table 4.1 Example prompts by category and metacognition sub-factor**

<table>
<thead>
<tr>
<th>Prompt</th>
<th>Category</th>
<th>Metacognition sub-constructs</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflect back on an intercultural interaction you have had in your career where you did not meet your objectives. Knowing what you know now, please use at least one concept/idea from the readings to explain what you would have done differently.</td>
<td>Thinking Back</td>
<td>Monitoring Learning</td>
<td>Post-reading, pre-seminar reflection</td>
</tr>
<tr>
<td>Within this first month at CSC, you will complete an Initial Writing Assessment (1100A) and a Leadership in the Profession of Arms Writing Assignment (2100A). What did you learn in preparing for this seminar that might influence your approach and analysis of relevant Profession of Arms issues? What do you want to find out more about before writing these papers?</td>
<td>Thinking Ahead/ Thinking Broadly</td>
<td>Planning Learning</td>
<td>Pre-seminar reflection</td>
</tr>
<tr>
<td>What is the connection between the concept of critical thinking and the profession of arms?</td>
<td>Thinking about thinking</td>
<td>Knowledge of Cognition</td>
<td>Reflection prior to beginning seminar preparation</td>
</tr>
<tr>
<td>Based on your own experiences, how would you describe the US strategic culture and, in particular, its “way of war”? Do you think they are unique?</td>
<td>Thinking across</td>
<td>Knowledge of Cognition</td>
<td>Reflection prior to beginning seminar preparation</td>
</tr>
<tr>
<td>Does any of the material connect to other CSC courses such as Leading Diverse Teams or Emotional Intelligence and does it connect with your prior leadership experiences either with you as a leader or your observed experience of other leaders? How did this make you understand your own leadership style differently?</td>
<td>Thinking across/T thinking back</td>
<td>Evaluating Learning</td>
<td>Post-reading, pre-seminar reflection</td>
</tr>
</tbody>
</table>
Primarily, these reflective questions were designed to improve students’ regulation of cognition (Schraw & Moshman, 1995). Within the construct of regulation of cognition, there are three sub-constructs: planning learning, monitoring learning, and evaluating learning (Schraw & Moshman, 1995). The category for basic metacognition includes prompts that relate to metacognition in general. Planning learning relates to the categories for thinking broadly about connections to the student’s research and thinking ahead to application of learning in future classes and career. Monitoring learning is related to thinking back, and evaluating learning is related to thinking back to prior learning and well as thinking across courses.

In addition to the above major elements of the intervention, the following three supporting elements were present. First, CSC sought to improve student knowledge of their own and others’ cognition via foundational, early-year lectures and seminars about cognitive bias, emotional intelligence and other concepts. Versions of most of these lectures and seminars occurred in previous academic years also. Secondly, faculty participated in faculty development designed to familiarize them with the use of the metacognitive reflection prompts as well as a general familiarization with the theory of metacognition. Finally, some of the individual metacognitive reflection prompts related to other barriers or spurs to creativity, including authoritarianism in the military, cognitive bias, divergent thinking, open mindedness, and psychological safety.

As a result of the intervention, two intermediate outcomes were expected. First, researchers hypothesized that students would display greater levels of metacognitive knowledge of cognition. This outcome would primarily result from the supporting elements of the intervention, specifically the foundational lectures and seminars about
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cognition. Secondly, mostly as a result of the structured reflection prompts, researchers hypothesized that students would realize growth on the posttest evaluations of student metacognition via the metacognitive awareness inventory (Schraw & Dennison, 1994).

Finally, researchers hypothesized that if both of the above intermediate outcomes occurred, then student theses would be of a higher creativity level than previous years. Additionally, some more distal outcomes, outside the scope of the study, are hypothesized. As with a similar study at the U.S. Military Academy, students would be expected to win more awards and publish more articles in military journals based on their theses (Shay et al., 2019). Finally, the ultimate aim of this intervention was to develop graduates who demonstrate greater creative problem-solving ability in their future jobs.

**Logic Model**

The logic model in appendix F provides a second way of describing the logic of the intervention. MCU efforts to improve student creative problem-solving ability within the structure of a graduate military educational institution provide the context for the model. Processes are input and outputs. Outputs include activities and participation. Inputs include a relatively unique “conference group” structure in which nearly all of the seminar-style discussions, which follow lectures to the whole college, are conducted in conference groups with the same 12 students in each group for the full academic year. The students in the 2022-2023 academic year were selected in a substantively similar process to previous years; MCU does not control this selection process. Similarly, the course content and major assignments were substantively the same as previous academic years.
The schedule of each day’s class varied but was determined in advance with all students studying the same thing each day for most of the year. Until academic year 2022, students were expected to do approximately three hours of reading each night to prepare for the next day’s seminar. In academic year 2023, the Director decided that all students would do two hours of reading and one hour of reflection per seminar meeting. In each academic year, there were also two major opportunities for students to study topics of personal interest. One way was the opportunity to take 2 one-credit electives in January. The second way that students could study topics of particular interest to themselves as individuals was through the thesis requirement, which was an opportunity for independent study under the guidance of a faculty advisor.

Foundational lectures on knowledge of cognition are an important precursor to regulation of cognition and these occurred primarily at the start of the academic years of the study (Miller et al., 2021; Schraw & Moshman, 1995). Throughout the 2023 academic year, using the hour of daily reflection time, students reflected individually. Reflections focused on planning their learning as well as monitoring and evaluating their learning (Evans, 2018). Key participants were the faculty council chair, who was responsible for the reflection activities and prompts as well as faculty development. Other participants were the students and the faculty who led conference groups and served as thesis mentors.

Finally, expected outcomes were short, intermediate and distal. Primarily, the expected short-term outcomes were an increase in reflection on the military context and the students’ work, and an increased knowledge of cognition (Evans, 2018; Miller et al., 2021). Expected intermediate outcomes included greater regulation of cognition and
increased divergent thinking (Schraw & Moshman, 1995). Expected distal outcomes were more creative theses that win more awards and lead to more publications (Shay et al., 2019). Additionally, graduates will hopefully transfer their increased creative problem-solving ability and divergent thinking to their future jobs (Evans, 2018; Marshall-Mies et al., 2000).

**Participant Recruitment**

All students participated in the treatment for academic year 2023 by virtue of the fact that they were students at CSC. Four conference groups of approximately 12 students each were designated as survey participants. For students from academic year 2022, two conference groups were designated as survey participants. Both of these academic year 2022 conference groups—serving as the comparison group—received some elements of the treatment, including primarily the lectures and seminars related to knowledge of cognition. One conference group also received feedback on their pretest survey results and reflected in class on an earlier version of some of the reflection prompts. Neither of the comparison conference groups received the full treatment, including formalized pre- and post-seminar reflection prompts and a reduction in the amount of required reading.

The surveys and products used—except the academic year 2023 posttest survey, the interviews, and thesis ratings—were collected for educational purposes by CSC and MCU staff. Following the approval of the institutional review boards, this secondary data was received from the MCU Office of Institutional Research, Assessment, and Planning. Data was de-identified before being provided to the author.

Interviews with faculty and students were conducted by the author, following IRB approval. Participation in the interviews was voluntary and no identifying information
was shared with any other students, staff or faculty of MCU. The faculty population was a mix of military officers and civilians, most of whom have doctorates. Military faculty were senior military officers at the same rank or higher than the author, who conducted the research in his personal capacity as a student at Johns Hopkins and not in an official capacity as a military officer. Military students involved in this phase of the research generally held a lower rank than the author. The student population included mid-career military officers from the US and other countries along with some civilians from the US national security community. All participants were adults and English speakers.

Faculty and student participants were recruited by email and word of mouth. Government contractors who served as faculty were excluded from participation. International students and interagency civilians were excluded from the posttest survey only. Interviews were recorded, after permission was granted by the interviewees, and lasted approximately 45 minutes each. There was no cost associated with participation and participants were not compensated in any way for participation. Participants received verbal consent forms before their interviews.

A separate, not human subjects research request was approved by the institutional review boards for thesis rating. Theses were publicly available online via the MCU library website. The present author redacted the thesis years of publication and student names for blind review purposes. The raters were colleagues of the present author and were solicited via email. Raters used the same AAC&U (2009) creative thinking rubric that MCU had used in previous years.
Outcome Evaluation Questions

1. Do students in the intervention group show greater growth in metacognition than students in the comparison group?

2. Do students in the intervention group demonstrate greater creative problem-solving ability on theses than students in the comparison group?

3. How do students and faculty describe the ways that the intervention impacted student metacognitive ability and creative problem-solving ability?

Hypotheses

1. The intervention group of students will show significantly greater positive change in metacognitive knowledge and regulation scores as compared to the comparison group of students.

2. The intervention group of students will score significantly better in the creativity of their theses than the comparison group.

Outcome Evaluation Design

This study used a mixed methods explanatory sequential design. An explanatory sequential design uses quantitative methodology to explore outcomes and then uses qualitative methodology to explain the quantitative findings (Creswell & Plano-Clark, 2018). This study examined two quantitative research questions concerning metacognition and creativity. The study then relied on qualitative open-ended survey results and interviews in order to attempt to explain the relationships between the metacognitive and creativity scores.

Because the study used an explanatory sequential design, it fits within the Use Branch, which Mertens (2018) describes as part of the pragmatic paradigm. As such, this
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study takes advantage of whatever research methodology is best for answering the questions at hand (Mertens, 2018). Some members of the quantitative or qualitative research communities criticize the use of mixed methods research as not having a philosophical foundation, but Johnson and Onwuegbuzie (2004) counter that mixed methods research arises out of the pragmatic philosophical tradition. In addition to accepting multiple research methods, depending on the question being explored, the pragmatic tradition also recognizes the intersubjectivity of knowledge as well as the fact that knowledge is always provisional and can change (Johnson & Onwuegbuzie, 2004).

The intervention in this study was a new intervention for the University. University faculty wanted to determine its effectiveness, and the results of the outcome evaluation of the first two research questions can help to make that determination (Mertens, 2018). Subsequently, the qualitative data can help to describe why or how it was effective (Mertens, 2018). Onwuegbuzie and Leech (2006) point out that a causal-comparative research design can use quasi-experimental methods, with qualitative data allowing additional comparison of groups after the quantitative data is known (see also Shadish et al., 2002).

Moreover, as Rossi and colleagues (1999) point out, the practicalities associated with doing evaluations, as applied research in real-world settings, require pragmatism when balancing validity with timeliness and usefulness. Toward that end, this study used a quasi-experimental design rather than a randomized control trial (Shadish, et al., 2002). Specifically, the study took advantage of the cohort model in use at CSC to examine differences in pre- and posttest scores between successive cohorts (Shadish, et al., 2002).
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Henry (2010) refers to this as a comparison group design, with the comparison group serving as a control.

Using the pre- and posttest design with both a comparison and treatment group allows for a basic value-added design (Henry, 2010). In the case of this study, MCU used the Metacognitive Awareness Inventory for Teachers (Balcikanli, 2011; Schraw & Dennison, 1994) during the fall 2021 semester in both September and December to measure student metacognitive awareness and ability. As a result, the students from academic year 2022 were able to serve as a comparison group while students from academic year 2023 served as the treatment group. Additionally, comparisons were made via blind review of de-identified student theses that were submitted in April or May for both comparison and treatment groups.

Of course, these students were not randomly assigned or matched between groups, so threats to validity exist (Shadish et al., 2002). However, these threats to validity need to be balanced against the usefulness of applied research (Shadish et al., 2002). In this case, because CSC wanted all students to receive the intervention and because analysis of data for the comparison group was secondary analysis of data already collected by the University, randomized design, matching or other more robust quasi-experimental designs were not possible (Henry, 2010; Torgerson et al, 2010).

**Strengths and Limitations of Design**

The most obvious limitation of this design is the lack of random assignment to treatment and control (Shadish et al., 2002). Because students were not randomly assigned, the study design cannot rule out effects like selection bias (Torgerson et al., 2010). Because of the real-world factors described above, a randomized control trial was
not possible. However, because this study was being conducted in a real-world setting, it was potentially more realistic in that its effectiveness might not rely on artificial and unrealistic conditions that sometimes exist in randomized control trials (Torgerson et al., 2010).

Still, because this study is not a randomized control trial, a major threat to validity for this study was selection bias (Henry, 2010; Shadish et al., 2002). Important differences between the students of academic year 2022 (comparison group) and the students of academic year 2023 (intervention) could exist. For instance, the pool of students and their experiences changed, especially with the recency of lessons learned from a close observation of Russia’s war in Ukraine. In order to mitigate this threat to validity, the study compared pretest metacognition scores from each academic year and evaluated student products for assignments that did not change and that are completed at the same time of the year (the theses).

A second threat to validity was construct validity as it related to the construct of creative problem solving (Shadish et al., 2002). Anecdotally, faculty at CSC question whether or not creativity is something that can be accurately measured, especially using quantitative methods. The measure used for the creativity construct is more thoroughly described in the needs assessment, but it depends on the ratings of subject matter experts (Amabile, 1982). Likewise, though a well-used measure for metacognition exists, some faculty still experience skepticism about the ability to measure metacognition with a quantitative measure (Schraw & Dennison, 1994). One way to mitigate these types of threats is the use of qualitative interview data to attempt to explain the quantitative findings (Creswell & Plano-Clark, 2018).
This study used student theses to measure creative problem solving, even though these student products were not the subject of previous semiannual assessments of creativity at CSC. One might argue that theses are high stakes evaluations and the stakes might have caused some students to avoid risk (leading to reduced creativity). Indeed, the rubric used to evaluate theses included a section for taking risks. On the other hand, theses offered students the greatest freedom to explore and create of any assignments in the CSC curriculum. For no other assignment do the students have the opportunity to choose the topic or methodology of their work. Moreover, the thesis is the only assignment for which the students are not responding to pre-planned faculty-created prompts. So, the risk of creativity is great (high stakes assignment), but the opportunity to create is unparalleled. Thus, using theses to evaluate creative problem solving can be construed as both a strength and a potential weakness.

A final threat to validity was low statistical power, which means that the sample sizes for creativity and metacognition might not have been strong enough to detect differences between the pre- and posttest or between the comparison and control groups (Shadish et al., 2002). The sample of students that received the surveys for the comparison group for this study was relatively very small (n=26) and the size of the intervention group was likewise rather small (pretest n=49; posttest n=38). The sample size for the rating of theses was also small (n=44). Having a low sample size lowers the chance that real differences between the groups will be detectable in the results of the statistical tests (Shadish et al., 2002).

Moreover, the low statistical power due to sample size can interact with other related threats to validity (Shadish et al., 2002). In this case, if students’ pretest scores
clustered around the top end of the metacognition scale, this might lead to increased difficulty in realizing a statistically significant effect (Shadish et al., 2002). Additionally, constructs like creativity and metacognition might take longer to improve than the study allows, which would again decrease the chance that a statistically significant result could emerge (Shadish et al., 2002).

The major method of mitigating concerns about statistical power is to increase the sample size, but that method was not available for this study (Shadish et al., 2002). Likewise, though matching or regression discontinuity design would help to increase power, these strategies were also not available for reasons discussed above (Shadish et al., 2002). One important strategy was available: using homogenous participants (Shadish et al., 2002). Since this study was conducted in an intermediate-level professional military institution, the participants were relatively homogenous, compared to other higher education settings. Moreover, the comparison of pretest metacognition scores from the control and treatment groups was used to validate the assumption that the two groups were substantially similar. Such homogeneity comes with a trade-off in generalizability, but that trade-off is acceptable given the purposes of the study (Shadish et al., 2002).

Outcome Evaluation Measures

This study used two quantitative outcome evaluation measures (see appendix G). The first, the consensual assessment technique, has already been described in the needs assessment (Amabile, 1982). The second outcome evaluation measure is the Metacognitive Awareness Inventory, which was designed to measure participants’ knowledge and regulation of cognition (Schraw & Dennison, 1994). The original measure included 52 items, but the measure used by CSC for academic year 2022 used 24
items (Balcikanli, 2011; Schraw & Dennison, 1994). Each item uses a five-point Likert scale for responses ranging from strongly disagree (1) to strongly agree (5) (Balcikanli, 2011). Schraw and Dennison (1994) found that the scales for knowledge of cognition and regulation of cognition had high internal consistency (between .93 and .88). Based on factor analysis, the survey includes two main factors with six subscales (Schraw & Dennison, 1994). The subscales for planning, monitoring, and evaluating, within the regulation of cognition factor, are relevant to this study, though none reached above the desired criterion value of .80 (Schraw & Dennison, 1994). The survey had good reliability (Cronbach’s alpha = .90) and validity, in that it was predictive of pretest results for related constructs (Schraw & Dennison, 1994).

CSC did not use the original Metacognitive Awareness Inventory in the 2022 academic year. Instead, CSC used a modified version of the Metacognitive Awareness Inventory for Teachers (Balcikanli, 2011). This inventory measures students’ perceptions of their metacognitive knowledge and ability. Advantages to the Metacognitive Awareness Inventory for Teachers include that it is shorter and that each of the six theoretical sub-factors is supported by factor analysis (all factor loadings exceed .5 and nearly all items—except the planning sub-factor items—have factor loadings above .6) (Balcikanli, 2011). Unfortunately, the Metacognitive Awareness Inventory for Teachers is designed for teachers, not for adults in general—as the original survey had been (Balcikanli, 2011). To compensate, CSC changed items that mentioned “teaching” to read “learning” instead. Though these substitutions are not ideal, this study continued the use of the modified metacognitive awareness inventory in order to facilitate comparison across years. See Appendix H for the modified inventory questions.
Examples of items, organized by factor, include the following:

**Knowledge of Cognition**: “I learn more when I am interested in the topic” (p. 474).

**Regulation of Cognition (Planning)**: “I organize my time to best accomplish goals” (p. 474).

**Regulation of Cognition (Monitoring)**: “I ask myself questions about how well I am doing while I am learning something new” (p. 474).

**Regulation of Cognition (Evaluating)**: “I ask myself if I learned as much as I could have once I finish a task” (p. 474).

In addition to the quantitative data gathered using the Metacognitive Awareness Inventory for Teachers, the outcome evaluation used open-ended survey items at the end of the posttest surveys for students in academic year 2023. These items focused on student perception of the effectiveness of each element of the invention for their metacognitive development and creative thinking on the papers evaluated. Moreover, students and faculty were invited to participate in interviews to explain their perception of the intervention and its relationships to changes (or the lack thereof) in student metacognitive ability and creativity throughout the year. See appendix G for the outcome evaluation matrix.

**Process Evaluation Plan**

This study looked at three process evaluation components: fidelity of implementation—adherence, fidelity of implementation—quality of program delivery, and participant responsiveness (Dusenbury et al., 2003). Process evaluation was accomplished via the open-ended student survey questions and the student and faculty interviews. Students were the focus of this intervention, so their voice relative to the
quality of the intervention is important (Rossi et al., 1999). Faculty who participated in
interviews were stakeholders in the implementation of the intervention, but were not the
focus of the intervention. Nevertheless, their voice is important to include as
collaborators in the intervention, instead of merely as employees to be evaluated (Rossi et
al., 1999).

**Process Evaluation Questions**

1. To what degree did the new curriculum differ from the prior teaching practice of the
faculty?
2. To what extent did faculty believe the new curriculum met their needs?
3. To what extent did faculty follow curriculum guidelines?
4. To what degree did the students honor the purpose of the pre-seminar reflection
portion of the intervention?

**Fidelity of implementation—adherence**

    Adherence is a measurement of how an intervention was implemented relative to
how it was designed (Dusenbury et al., 2003). The foundational first step in measuring
adherence is to identify what are the key components of the intervention and then to
determine if, and how well, those components were implemented (Dusenbury et al.,
2003). In this intervention, key components included metacognitive thinking prompts
related to planning, monitoring and evaluating one’s learning (Schraw & Moshman,
1995). As reflected in the theory of treatment, these prompts were implemented
individually by students and in seminar discussions (Miller et al., 2021). Within the logic
model, these prompts are listed as activities in the output column.
In considering this component, adherence was considered via faculty and student qualitative interviews and student responses to the open-ended survey questions on the posttest. Dusenbury and colleagues (2003) report that adherence should sometimes be balanced with reinvention. Reinvention is essentially the adaptation of an intervention to one’s specific circumstances, and can sometimes be a good thing, given the fact that faculty have a greater knowledge of the context and that the prompts used in the intervention had been newly adapted from other contexts (Dusenbury et al., 2003). For this reason, and because faculty should be treated as partners in the intervention (see logic model), a certain degree of reinvention should be tolerated or even encouraged. At the same time, because this is a military context, faculty were likely to report high rates of adherence, which might exacerbate existing self-report biases (Dusenbury et al., 2003).

**Fidelity of implementation—Quality of Program Delivery**

Quality of program delivery covers the extent to which the prompts were perceived to be implemented effectively (Dusenbury et al., 2003). As indicated above, adherence asks if the content, activities, etc. were implemented as planned, but quality of delivery asks how well the intervention was implemented (Dusenbury et al., 2003). Generally, quality of program delivery includes an observer rating of a teacher or provider’s effectiveness (Dusenbury et al., 2003). Because faculty are participants in the intervention, and not beneficiaries of the intervention, the focus on quality in this case was the quality of the prompts.

The prompts for this intervention were adapted from other contexts. Faculty, as partners, reported on the effectiveness of the prompts for encouraging student discussion.
related to metacognition. Faculty were also asked to describe how they modified their teaching, if at all, to incorporate the prompts.

**Student responsiveness**

Finally, this project sought student input for responsiveness. Participant responsiveness looks at how engaging an intervention is for the participants (Dusenbury et al., 2003). For the purposes of this study, engagement was operationalized by the amount of effort that students reported that they and their peers put into the metacognitive activities (Dusenbury et al., 2003). The faculty interviews also included questions about their perceptions of student responsiveness.

As indicated in the logic model, students were the intended beneficiaries of the intervention. Regardless of how much effort the faculty put into designing and implementing metacognitive prompts and activities, student engagement was key to the effectiveness of the prompts. Thus, student engagement could be an indicator of the quality of the prompts.

**Indicators of the Process Evaluation**

The data collection matrix for this process evaluation is found in appendix I. The first process evaluation question asks to what extent faculty followed the curriculum guidelines related to the new metacognition prompts. The second process evaluation question asks to what extent the faculty felt that the new curriculum (metacognition prompts) met their needs. The third question asks how much effort the students put into the activities associated with the intervention. The following sections will consider each indicator for each of these questions.
Adherence: Frequency of use

Understanding how often faculty used the prompts provided can be used to help determine to what extent faculty followed the curriculum guidelines. Faculty participated in qualitative interviews, which included questions about adherence (see Appendix J). Students also participated in qualitative interviews and provided their perspectives on faculty adherence (see Appendix K).

Adherence: Reinvention

Reinvention can sometimes be a positive process to adapt any given intervention to one’s current context. Therefore, an intervention needs to balance a certain degree of positive reinvention with maintaining the key aspects of an intervention (Dusenbury et al., 2003). In order to capture reinvention and determine the extent to which it might modify key aspects of the intervention, faculty were asked questions in the qualitative interviews about reinvention.

Quality of Program Delivery: Effectiveness

Quality is concerned with the effectiveness of the intervention (Dusenbury et al., 2003). In order to determine the extent to which the faculty felt prompts met their needs, an evaluation of the prompts themselves is useful. Faculty and students both reported on the usefulness of the prompts in their qualitative interviews. Students also reported on the usefulness of the intervention in their responses to open-ended survey questions on the posttest.

Quality of Program Delivery: Modification

For adherence, faculty were asked to report the extent to which they modified the prompts in the intervention. Conversely, for quality of delivery, the modification is to the
faculty’s normal teaching practices. If faculty report that they modified their normal teaching plans to incorporate metacognitive prompts—rather than merely adding them at the end—then this is an indication that the faculty took steps to increase the quality of their program delivery. Using the same qualitative interviews (see appendix J), faculty were asked to describe how they modified their teaching, if at all, to incorporate the prompts.

**Participant Responsiveness: Effort**

The process evaluation question for responsiveness asks how much effort students put into the intervention. The easiest way to operationalize effort is to ask students directly how much effort they put into the intervention. For this measure, the students responded to optional open-ended questions on the posttest survey. Qualitative interviews also attempted to gather information on student effort.

**Conclusion**

Amongst the faculty at MCU and key stakeholders across the Marine Corps, there is an emerging consensus concerning the importance of out-thinking one’s opponent. The process of out-thinking an opponent requires increased metacognitive ability and practice. Additionally, the result of out-thinking an opponent would include being a more creative problem-solver than one’s opponent. Previous efforts to increase creativity independently of an explicit connection to metacognition have had mediocre results.

In order to break out of this trend, CSC led the way for MCU in implementing a pilot intervention to remove barriers to creative thinking and to encourage metacognitive reflection. This study evaluated the outcome and the processes of the intervention and used an explanatory mixed methods design to attempt to explain the quantitative results.
of the intervention. Both the outcome and process evaluations are vital to the University as it attempts to learn how the experience of CSC in 2022-2023 can be modified and/or extended to other units of the University in the remaining years of the University’s strategic plan.
CHAPTER 5: RESULTS AND DISCUSSION

The intervention for this study was designed to target two key factors related to creative problem solving—metacognition and time. According to the results of the needs assessment described in chapter two, students and faculty both identified that students did not have enough time to think creatively about what they were learning in CSC. Several studies, discussed in chapter three, link creative thinking with the factor of time. Importantly, many of those studies conclude that structured reflection time is better for creative thinking than free time or allowing the mind to wander.

Thus, the intervention incorporated two main elements. The first was a reduction in the amount of time students spent reading or viewing materials in preparation for each day’s lesson. This reduction was roughly the equivalent of one hour per lesson. In other words, students spent two hours per lesson in reading or viewing learning materials, rather than the three hours per lesson that the school had previously assigned. The second element of the intervention was structured reflection. Faculty responsible for each lesson created structured reflection prompts designed for student reflection before, during and after each seminar discussion. These prompts focused on helping students plan, monitor, and evaluate their learning. Ideally, students would use the one hour per lesson gleaned from the reduced reading and viewing time in order to engage with these structured reflection prompts. However, students were not required to demonstrate, via any sort of assignment or log, that they had considered the structured reflection prompts.

According to the logic model for the intervention (see Appendix F), described in chapter four, having additional time and structure for reflection should improve students’ metacognitive ability. More specifically, students should see an increase in their
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knowledge of their own cognition, which would lead to an increase in their regulation of their own cognition (their ability to plan, monitor and evaluate their learning). In turn, the increases in metacognition should lead to increased creative problem solving, embodied by more creative final research theses at the end of the academic year.

The metacognitive survey research and interviews were conducted under an amendment to the original institutional review board approval. The University’s Institutional Research, Assessment and Planning office conducted the Pre- and posttest surveys for academic year 2022 and pretest survey for academic year 2023. Results of those surveys were obtained via secondary data request. The final posttest survey was conducted by the present author. An additional research request was submitted and approved for the thesis rating portion of this study. Theses were publicly available online, prepared for blind review, and raters were not the subject of the research, so thesis rating portion of the study was determined to be not human subjects research.

Quantitative Results

This study used an explanatory mixed methods research design. The quantitative portion of the research design was quasi-experimental with pre- and posttests and a comparison and invention group. The comparison group was composed of students in academic year 2022 (n=26) and the intervention group was composed of students in academic year 2023 (n=48). Aside from the intervention, there was no substantial difference in how students were selected for each year group or in the curriculum as a whole, including the thesis writing and mentorship process. For the construct of metacognition, the study used a modified version of the Metacognitive Awareness Inventory for Teachers (Balcikanli, 2011). This instrument is a self-perception instrument
in that it uses a Likert scale to ask participants about their perception of their own metacognitive knowledge and ability.

To evaluate the creativity of student products, this study used the consensual assessment technique (Amabile, 1982) in which a group of subject matter experts evaluated the creativity of student final theses from academic year 2022 and academic year 2023. Each evaluator used the AAC&U (2009) creativity value rubric to rate the creativity of 8-10 papers in their areas of expertise. Each rater received papers that had been prepared for blind review, evenly divided between each academic year.

**Metacognition**

The Metacognitive Awareness Inventory for Teachers (modified in this study to replace questions about teaching with questions about learning) employs a Likert scale to ask students about their perceptions of their own metacognitive ability (Balcikanli, 2011). Two major factors are included in the survey: knowledge of cognition and regulation of cognition. The researcher conducted a MANOVA with each of the four survey administrations (AY22 pretest, AY22 posttest, AY23 pretest, AY23 posttest) as independent variables and each factor of metacognition as dependent variables (knowledge of cognition and regulation of cognition). Additionally, a Tukey post hoc test was performed to compare average scores across academic year and factor (Laerd statistics, 2018). Table 5.1 displays the results of that test.

For academic year 2022 (comparison group), 26 students from 2 seminar groups received the pre- and posttest surveys. Twenty-one students took the pretest in September 2021, while 22 students took the posttest in December 2021. Surveys were anonymous, so no paired samples data were able to be identified. Though the average scores for each
factor and subfactor were almost universally lower in the posttest, there was no significant difference in overall knowledge of cognition or in any of the subfactors of knowledge of cognition. For the factor of regulation of cognition, there was a significant decline (p<.1) between the pre- and posttests.

Table 5.1: Tukey Honest Significant Difference Post Hoc Test (factors)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>(I) TEST</th>
<th>(J) TEST</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>90% Confidence Interval</th>
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</thead>
<tbody>
<tr>
<td>Knowledge of Cognition</td>
<td>AY22 Pretest</td>
<td>AY22 Posttest</td>
<td>0.1438</td>
<td>0.12118</td>
<td>0.637</td>
<td>-0.1378</td>
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<td></td>
<td>AY23 Pretest</td>
<td>AY22 Posttest</td>
<td>0.1357</td>
<td>0.10659</td>
<td>0.582</td>
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</tr>
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<td></td>
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<td>AY22 Pretest</td>
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<td>0.12118</td>
<td>0.637</td>
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<td></td>
<td>AY23 Posttest</td>
<td>AY22 Pretest</td>
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<td>0.14254</td>
<td>0.915</td>
<td>-0.4243</td>
</tr>
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<td></td>
<td>AY22 Pretest</td>
<td>AY22 Posttest</td>
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<td>0.582</td>
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<td></td>
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<td>AY22 Posttest</td>
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<td>-0.2383</td>
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<td></td>
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<td>AY22 Pretest</td>
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<td>0.13036</td>
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<td>-0.2182</td>
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<td>Regulation of Cognition</td>
<td>AY22 Pretest</td>
<td>AY22 Posttest</td>
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<td>0.15777</td>
<td>0.092</td>
<td>0.0061</td>
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<td></td>
<td>AY22 Posttest</td>
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<td>0.15777</td>
<td>0.092</td>
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<td>AY22 Pretest</td>
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</table>

Based on observed means. The error term is Mean Square (Error) = .267.

* The mean difference is significant at the .1 level.  ** The mean difference is significant at the .05 level.
For academic year 2023 (intervention group), 49 students from 4 seminar groups received the pretest survey (including US military, international military and civilian interagency students). For the posttest, students from the same four seminar groups received the survey, but international students and civilian interagency students were excluded (see limitations section for explanation), so only 38 total US military students received the survey. Surveys were again anonymous. 41 students took the pretest in September 2022, while only 12 students took the posttest in April 2023. Thus, students in the intervention group received the posttest survey approximately four months later in the academic year than did students in comparison group. There was no significant difference between the pretests for the comparison and intervention groups in any factor or subfactor, which demonstrates that the comparison and intervention groups were sufficiently similar to each other at the start of the academic year. As with the comparison group, the intervention group showed no significant difference in knowledge of cognition or any of its subfactors, but there was a significant decline in regulation of cognition from the pretest to the posttest ($p<.05$). This decline was larger and more significant for the intervention group than the comparison group. Finally, there was no significant difference between the posttests for each year on either factor.

Regulation of cognition is the most important factor for this study because regulation of cognition was the main metacognitive target of the intervention. Because of its importance to the study, this study examines the regulation of cognition subfactors (planning learning, monitoring learning, and evaluating learning) in more detail in Table 5.2. Once again, there was no significant pretest difference in any subfactor between the
comparison and intervention groups, showing substantial similarity at the start of each academic year.

Table 5.2: Tukey Honest Significant Difference Post Hoc Test (subfactors of regulation of cognition)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>(I) TEST</th>
<th>(J) TEST</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>90% Confidence Interval</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
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<td></td>
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<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Planning Learning</td>
<td>AY22 Pretest</td>
<td>AY22 Posttest</td>
<td>0.2695</td>
<td>0.17402</td>
<td>0.413</td>
<td>-0.135</td>
<td>0.6739</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AY23 Pretest</td>
<td>AY22 Posttest</td>
<td>0.1664</td>
<td>0.15307</td>
<td>0.698</td>
<td>-0.1894</td>
<td>0.5221</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AY22 Posttest</td>
<td>AY22 Pretest</td>
<td>-0.2695</td>
<td>0.17402</td>
<td>0.413</td>
<td>-0.6739</td>
<td>0.135</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AY23 Posttest</td>
<td>AY22 Pretest</td>
<td>0.3674</td>
<td>0.2047</td>
<td>0.282</td>
<td>-0.1083</td>
<td>0.8432</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AY23 Pretest</td>
<td>AY22 Pretest</td>
<td>-0.1664</td>
<td>0.15307</td>
<td>0.698</td>
<td>-0.5221</td>
<td>0.1894</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AY23 Posttest</td>
<td>AY22 Pretest</td>
<td>0.4705*</td>
<td>0.18722</td>
<td>0.064</td>
<td>0.0354</td>
<td>0.9056</td>
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</tr>
<tr>
<td></td>
<td>AY23 Posttest</td>
<td>AY22 Posttest</td>
<td>-0.3674</td>
<td>0.2047</td>
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<tr>
<td></td>
<td>AY23 Pretest</td>
<td>AY22 Posttest</td>
<td>-0.4705*</td>
<td>0.18722</td>
<td>0.064</td>
<td>-0.9056</td>
<td>-0.0354</td>
<td></td>
</tr>
</tbody>
</table>

| Monitoring Learning | AY22 Pretest | AY22 Posttest | 0.2679 | 0.18129 | 0.455 | -0.1535 | 0.6892 |
|                     | AY23 Pretest | AY22 Posttest | 0.0209 | 0.15946 | 0.999 | -0.3497 | 0.3915 |
|                     | AY22 Posttest | AY22 Pretest | -0.2679 | 0.18129 | 0.455 | -0.6892 | 0.1535 |
|                     | AY23 Posttest | AY22 Pretest | 0.3542 | 0.21326 | 0.35 | -0.1415 | 0.8498 |
|                     | AY23 Pretest | AY22 Pretest | -0.0209 | 0.15946 | 0.999 | -0.3915 | 0.3497 |
|                     | AY23 Posttest | AY22 Pretest | 0.6011* | 0.19504 | 0.014 | 0.1478 | 1.0544 |
|                     | AY23 Posttest | AY22 Posttest | -0.3542 | 0.21326 | 0.35 | -0.8498 | 0.1415 |
|                     | AY23 Pretest | AY22 Posttest | -0.6011* | 0.19504 | 0.014 | -1.0544 | -0.1478 |
Based on observed means. The error term is Mean Square (Error) = .531.
* The mean difference is significant at the .1 level. ** The mean difference is significant at the .05 level.

For the comparison group, there was a significant decline (p<.1) in the subfactor for evaluating learning, but the intervention group did not show a significant decline in this subfactor. However, the intervention group did show a significant decline in planning learning (p<.1) and monitoring learning (p<.05). Again, there was no significant difference between the posttests for each group in any subfactor.

**Thesis creativity**

Using the consensual assessment technique and the AAC&U creativity value rubric (Appendix A), five raters evaluated a sample of theses from each academic year (Amabile, 1982; AAC&U, 2009). Because Amabile’s consensual assessment technique calls for raters to be experts in the field of the work, the raters were five officers on the staff of a Marine component command. Marine component commands work at the operational level of war, which is the focus of the CSC curriculum.

All of the raters were graduates of intermediate-level professional military education (the same level as CSC). Three of the raters were lieutenant colonels (the same...
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rank as the majority of the military faculty of CSC). Two of the three lieutenant colonels had also received the foreign area officer designation for additional master’s-level study and experience with foreign militaries. The other two raters were majors (the same rank as the majority of the students at CSC), but these two raters had completed advanced, US government-funded, follow-on strategic master’s degree education after completing basic intermediate level professional military education. Additionally, one possessed a terminal degree and the other was a doctoral student.

In total, raters reviewed a sample of 44 theses, with 22 from each academic year. Theses selected were not limited to the theses submitted by students in the intervention and comparison survey samples, but from amongst all of the theses submitted for each academic year. The reason for this was the need to find enough theses in each content area within the subject matter expertise of the raters. The five content areas (and areas of expertise of the raters) were China, Expeditionary Logistics, Aviation Logistics, the wider US Indo-Pacific Command area of responsibility, and law and ethics. These topics were selected to match the expertise of the raters and to ensure that four to five papers in each area existed for each academic year.

Raters judged that 27% of the theses were creative or transformative, as defined by the AAC&U (2009) rubric. The exact same number of theses from each academic year were rated as creative or transformative. Figure 5.1 shows the results of the ratings, broken down by academic year group and element of the rubric. A score of 2.5 or above, on a scale of 0-4, indicates that a thesis was rated as creative or transformative. Only one thesis in the entire sample was rated as transformative (3.5 or above). This transformative thesis was from the intervention group. On average, theses in this sample scored a 1.94,
firmly in the “adaptive” range. Similarly, for each element of the rubric, average scores remained in the “adaptive” zone. Overall, and for five of the six elements of the rubric, papers in the intervention group scored higher on average than papers in the comparison group, but a MANOVA comparing between-subject effects found that none of these differences was significant at the p<.1 level (Laerd Statistics, 2018).

**Figure 5.1 Average creativity rating for theses by academic year (n=44)**

![Average Creativity Rating Chart]

Interestingly, based on scores in both groups combined, students scored highest in “connecting and synthesizing” and lowest in “taking risks.” For the comparison group, the highest score was “connecting and synthesizing,” while the lowest score was “innovative thinking.” For the intervention group, the highest score was “solving
problems” and the lowest was “taking risks.” The greatest similarity across groups was in the relatively low scores for “taking risks.” The scores for “embracing contradictions” were also relatively low across both groups, with scores in the comparison group approaching the level of “imitative” on the AAC&U (2009) rubric.

Additionally, for each rater, based on the scores provided, papers were ranked from 1-8 or 1-10. A lower average ranking indicates that the average paper from that academic year was more creative than an average paper from the other academic year sample. Papers in the intervention group were ranked (4.37), on average, more than half a rank better than papers in the comparison group (4.95). However, a MANOVA found that this difference was not significant at the p<.1 level (Laerd Statistics, 2018).

**Qualitative Results**

For qualitative explanation of the quantitative results, this study used two primary methods of data collection and a supplemental method. First, as part of the posttest survey, students were given the opportunity to respond to two open-ended questions focused on the usefulness of the reflection prompts and the trade-off between the amount of reading materials and the time students had to think creatively. Secondly, interviews were conducted with students (n=5) and faculty (n=4) from academic year 2023. The supplemental method was a review of comments provided by thesis raters on their rating sheets. Raters were not asked to provide comments, but three of them did so.

**Open-ended posttest survey**

The academic year 2023 posttest survey gave students the option of replying to two open-ended questions about the usefulness of the structured reflection prompts and about the balance between reading material and time. These were the two elements of the
intervention. Only 12 students completed the posttest survey and 10 of them provided responses to the open-ended questions at the end.

Concerning the usefulness of the structured reflection prompts, some students said that they were useful but didn’t provide much explanatory background. Students who believed that they were not useful provided much more justification for their answers. One student felt that the questions were unfair in that they were leading them toward a certain conclusion. Another student felt that the questions were confusing. Other students complained that the questions were rarely used in the seminar discussion and that each lesson card’s second question, in particular, was an afterthought and repetitive across lesson cards. This was a question that asked students to think about how the readings or seminar discussion challenged their thinking. Of particular note, two students complained that they didn’t have enough time or mental energy to do the readings and the reflective questions, in spite of the fact that required readings were substantially reduced for the intervention.

The open-ended question about the balance of reading/viewing materials and time for reflection yielded more detailed responses. Most of the respondents felt that there was enough time for reading and reviewing the structured reflection questions. However, many students identified differences in the quality of the reading materials as well as the quality of the reflection questions. Moreover, a few students stated that some of the reading materials could be redundant (covering the same background material) or irrelevant, and that readings from blogs were much easier to digest than those from academic journals or books, even if the total number of pages were the same. One student said that there was not enough reading for a graduate program.
Student and Faculty Interviews

After the survey results were analyzed, the same group of students were invited to participate in one-on-one interviews to explain the results of the quantitative survey and examine elements of the intervention related to adherence, quality of delivery and participant responsiveness. Students answered questions designed to elicit information in explanation of the quantitative survey outcomes as well as the quality of the survey itself. Students were solicited for participation via email. Due to low participation rates, additional students from outside of the survey sample were also asked to participate.

In total, five students agreed to participate in interviews. Three of these students were international military officers and one was a US Air Force officer. Only one interviewee was a US Marine. One of the interviewees was a woman and one was Hispanic. Of particular note, three of the interviewees were selected to remain at MCU for another academic year in order to complete the highly selective, advanced-intermediate Master of Operational Studies from the School of Advanced Warfighting. As such, these three were top performers at CSC, not average students.

Finding volunteers for student interviews proved difficult. Of the group of students originally solicited to complete interviews, only one student volunteered. Additional students recommended by faculty were solicited by a supplemental email and two more signed up. Finally, students who remained at MCU for a second academic year at the School of Advanced Warfighting were invited to participate after their next academic year had already begun. As such, only one of the students remembered completing both the pre- and posttest surveys. One student remembered completing only the pretest.
Four faculty members also participated in interviews. Like students, the faculty were given the opportunity to try to explain the survey results, and they also answered questions about adherence, quality of delivery, and participant responsiveness. Moreover, faculty were also interviewed about program differentiation. Of the faculty participants, two were women and two were men. Three were civilian faculty members and one was a military faculty member. The faculty taught in the following areas: war studies/military history (n=2), leadership/security studies (n=1), and leadership/warfighting (n=1).

Adherence

Faculty and students responded to questions about adherence. Unsurprisingly, faculty reported that they followed the guidance found in the lesson card. Some of those interviewed were responsible for writing lesson cards. However, the lesson cards do not mandate that the faculty use the reflective questions in their seminars, only that the students consider the questions before and after seminar discussion. When asked how often they used the reflective prompts in classroom discussion, faculty agreed that they used them half of the time or more. Students who were interviewed stated that only some of the faculty used the prompts in the discussion. As a result, some students stated that they would think about the reflection questions for the seminars when they knew the faculty would discuss those questions in the seminar, but they would not look at the reflection questions if they knew the faculty were not going to use them. Three faculty members also stated that it is easier to develop reflective questions for certain subjects (e.g., leadership) than for others (e.g. military history), but one military history faculty member disagreed. More than one student echoed this comment.
Quality of Delivery

Both students and faculty responded to questions about the quality of delivery of the intervention. Faculty generally felt that the reflection prompts were useful most of the time. Some faculty reported that they needed to modify some of the reflection prompts. One faculty member particularly called out the use of the same reflective prompt over and over. This faculty member argued that students noticed when little thought was devoted to developing the prompt and would put little effort into thinking about those prompts that seemed to be cut and pasted from a template. For instance, use of the words “this topic” instead of naming the issue was a clue that little effort went into the reflective prompt for that day’s lesson card. Another faculty member said that some authors of reflection prompts did not buy into the concept and so they were just “going through the motions.” This faculty member suggested convening a workshop at the start of the academic year in order to develop better reflection prompts.

Similarly, some students complained about the quality of the prompts on some lesson cards, including calling out the second reflective question as being basically the same across lesson cards. The “boilerplate” approach to asking “how has your thinking changed” was a cue for putting less thought into that particular question, especially as the year went on. Another problem with that particular question emerged in the area of military history. If the student had never thought about Napoleonic warfare before, asking them how their thinking on this topic has changed is not useful. War Studies in particular was highlighted as a subject in which the reflective questions were not helpful. In general, the consensus was that the quality of delivery varied primarily based on the
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faculty member teaching the course. Two respondents felt that the quality decreased over the academic year, but most did not feel that way.

The amount and quality of the reading materials also influenced the quality of delivery of the curriculum as a whole. Hypothetically, the reduction in the amount of reading could negatively impact the students’ learning and creativity as the readings provide foundational knowledge from which to think creatively. Most faculty interviewed generally did not believe that the reduced amount of reading impacted student creativity. Instead, they felt that the quality of the reading material was more important than the quantity. Most of the students found the amount of reading to be appropriate and added that if they wanted to read more, then there were usually supplemental materials provided for further learning.

However, one faculty member (who teaches in military history) felt strongly that the reduction in the number of pages of reading had an important negative effect on student learning. Specifically, this faculty member stated that 20 pages is roughly the length of one article. By reducing the reading by one article, students received a less diverse set of perspectives. This faculty member stated that reflection and reading “should not be a zero-sum game” and went on to say, “I feel very strongly that it should not be active reflection time built in at the expense of reading. I don’t think that we need to have a block of time that is devoted to active reflection in lieu of the richness that comes with being informed on a topic.” Moreover, this same faculty member offered that most military history lessons will only have one pre-seminar reflective question and no post-seminar reflective questions, and that the number of pages of reading will go back up to 80 for those lessons.
Participant Responsiveness

Students who completed interviews reported that they usually spent time before each seminar on the reflective questions. One student reported spending a full hour for each lesson card. Other students reported spending less than an hour on reflection for each lesson, with one student pointing out that they would also think about the reflection questions while doing other things, like driving or exercising. Some students reported that they spent more time on the reflective questions for certain topics than others, and three students reported that they spent more time at the start of the year than at the end.

Since most of the interviewed students were the top performers in their classes, the interviewer also asked them about how often they thought their peers used the reflective questions in preparation for each day’s lesson. They might gather this information in conversation before class or based on the number of times a student would bring up the reflective questions in seminar discussion. One student felt that their classmates always came prepared and ready to discuss the reflective questions—this student said they were lucky to study with such a great group. Other students felt that there was a lot of variation between students about how much they used the reflective prompts. One student in particular said they thought that about one-quarter to one-third of the students used the reflective prompts and the others were just happy that there was less reading to do. This student also felt that fewer students completed both the reading and the reflection as the year went on.

Some faculty felt that the students usually used the reflective prompts to prepare for class, and these faculty members specifically pointed to reinforcing this behavior by using the prompts in the seminar discussion. Another faculty member felt that only about
10-25 percent—the top performing students—seriously considered the reflection questions prior to the seminar discussion. Two faculty members felt that the students completed pre-seminar reflection more at the start of the year than at the end.

**Program differentiation**

One possible explanation for why there was little change between the comparison group and the intervention group is that the intervention was not substantially different from pre-existing teaching practice. For instance, if most of the reflective questions were already things that students discussed in previous years, then one might not expect to see much change in outcomes merely by formalizing these prompts on the lesson card. Two faculty stated specifically that having the reflection prompts on the lesson card did not change the way that they approached teaching the seminar discussions. These types of questions were already the types of questions that they would have asked students in the discussion. Though these faculty felt that they did not change the way that they taught their seminars, they did feel the reflective prompts helped students to prepare for each day’s discussion. Another faculty member felt that the reflection prompts were a better way to start off each day’s seminar than the way they had previously been doing it.

One faculty member suggested that it would have been more impactful if there was some “forcing function” to ensure that the students did the reflection. Another faculty member reported that they felt that student pre-seminar reflection changed the quality of the classroom discussion because there was more vulnerability. Of note, this faculty member had students sometimes reflect together via a Google Doc prior to the seminar.
**Survey construction**

Students were also given the opportunity to comment on the quality of the metacognition survey itself. Unfortunately, only one student remembered anything substantial about the survey and only two students who completed interviews took one or both of the pre- and posttests. One student vaguely remembered that they did not have any particular complaints about the survey and stated that it was shorter than most of the surveys they completed during the academic year. The one student who remembered the survey said that it was more difficult than other surveys because of the terminology used and that this might have impacted the effort that students put into completing it. This student suggested that the survey could have used a longer introduction in order to get the students interested in completing it. All students and some faculty also mentioned that there were a very large number of surveys required throughout the year and that some students probably experienced survey fatigue. In fact, one student suggested that other students might have rushed through the survey by choosing middle answers for the posttest.

**Expected outcomes**

Faculty and students were asked to describe how they thought the intervention, primarily the structured reflection questions, might impact students’ ability to regulate their learning as well as their overall creativity and creativity on the thesis. Concerning the ability to regulate learning, students reported that the reflective questions designed to get them to think back to their prior experience or to think forward to future responsibilities in the operating forces were the most effective. When asked specifically about planning learning, students reported that the structured reflection prompts helped to
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guide their reading and prepare them for seminar discussions, which is consistent with faculty reports that classroom discussions improved. When asked to think about monitoring and evaluating learning, responses were more mixed. One student in particular found the reflective prompts useful for monitoring and evaluating learning because they would go back after the seminar and think about what other students had drawn from the readings. No other students described spending much time after each day’s seminar on reflection, though some claimed that the reflective prompts helped them to monitor or reflect. One faculty member questioned whether or not the reflective prompts really gave the students the tools they needed to evaluate their learning.

Responses were mixed about whether or not the reflective prompts helped students to think creatively about the curriculum. One student said that “if MCU would not have told me that there was a connection, I would not have figured it out myself.” Some faculty felt that there was potential for the structured reflection to increase creativity, but that there needed to be more of a whole school approach. One student felt that the reflective questions were not helpful for creative thinking because they were not designed to get students to think creatively. Other students reported that it depended on the class and the professor. One faculty member felt that the reflective prompts helped to prime the students for creative thinking by helping to focus their thinking. Similarly, two students specifically stated that the reflective questions provided a foundation for creative thinking in that the questions helped students to explore their own thinking and helped to identify “reference points.”

When asked specifically about the connection between the structured reflection questions and creativity on the theses, there was generally consensus that there was
probably no connection. The structured reflection questions did not ask about the thesis and all of the students felt that the topics of their theses were not connected to the structured reflection questions. Students also pointed out that the topics of the theses are chosen very early in the year, before the reflective questions could have much impact. One faculty member suggested that it would be useful to have structured reflection questions for the thesis writing process in the future.

**Explaining the outcomes**

During each of the interviews, the interviewer described the quantitative results of the survey to each participant. The participants did not have a long time to think about how they would explain these results, but they were given the opportunity to do so. Each of the respondents pointed to problems related to survey fatigue. They all felt that, by the end of the academic year, students were tired of taking surveys. One student, who did not complete the survey, questioned whether or not the sample was generalizable to the entire academic body. This student speculated that the group of students who received the opportunity to complete the survey might not have been representative of the rest of the student body.

When asked if they were surprised to hear that there was no significant change in knowledge of cognition between the pre- and posttest surveys, most participants were surprised. One student admitted that their experience might have been different than others, but stated that “CSC was very useful for providing me knowledge and a way to structure my knowledge.” One faculty member said they assume that the longer the academic year went on, the bigger the improvement would be.
Participants were even more surprised to find that scores for regulation of cognition declined significantly between the pre- and posttest. All participants seemed to agree that they observed metacognitive growth in themselves (students) or in some of their students (faculty). One student’s comment summarized the belief that their own experience did not match the survey results: “I didn’t see necessarily my ability to plan or evaluate or monitor my own thinking as a deteriorated capacity based on my year in CSC. If anything, I thought it only sharpened my skills.” Participants generally felt that this decline had to be related to the survey instrument itself and the fact that the survey asks participants about their perceptions of their ability to regulate their cognition. Other opinions about why scores declined had to do with the timing of the survey as it related to the thesis due dates.

Most of the participants felt that the Dunning-Kruger effect might explain the results of the survey (Kruger & Dunning, 1999). Some came up with this explanation on their own while others agreed with the explanation after the interviewer offered it to them. According to this idea, students' real metacognitive ability was lower at the start of the year than at the end. However, because they had spent little time reflecting on their metacognitive ability before they arrived at CSC, they had a higher opinion of their ability at the start of the year. One student felt that “at the beginning of the year, we are on the far left of the curve and then by the end, we are at the middle and going up again.”

Another related explanation offered by some participants was that students’ confidence in their own metacognitive ability was challenged by the faculty. Whether or not they improved later in the year, they scored much lower on certain assignments than they expected and this caused them to rate themselves lower. Others speculated that the
more you reflect, the more you realize you do not know. Faculty specifically reported hearing this from students throughout the year.

Another possible explanation is that students who did not complete the reflection prompts rated themselves lower at the end of the year because they were thinking about the fact that they did not do the reflection. Perhaps at the start of the year, they did the reflective activities and scored highly on the pretest survey, but at the end of the year, they were no longer doing the reflective activities, so they scored themselves lower on the posttest. This particular explanation was especially convincing to one of the student participants who completed only the pretest.

*Other interview comments*

Participants were offered the opportunity to make additional comments at the end of the survey. One faculty member specifically focused on the need to ensure students actually complete reflective activities and specifically questioned the level of motivation of many of the students. One student offered that CSC needed to improve the way that students are encouraged to think creatively. This student specifically pointed to some military and civilian faculty who place limits on how critical or creative a student can be, given their rank and the authority of the institution or the individual whose ideas they are questioning.

All students took the opportunity to specifically state that they felt their time at CSC was valuable. One felt that reflective questions should not be tied to any specific lesson card, but should consider the curriculum as a whole. Students should have a great opportunity to reflect across courses and not just reflect on one day’s reading material.
Similarly, one faculty member felt that reflection had to be integrated more fully into the curriculum as a whole.

**Comments from Thesis Raters**

Three of five subject matter experts who rated theses provided comments with their ratings. For those papers that were rated as less than creative, the raters often complained that problems were glossed over, that alternative explanations and solutions were not considered, or that the papers described problems well but sometimes failed to offer specific solutions. On the other hand, for the 27 percent of theses that were rated as creative or transformative, common themes were that the students addressed contradictory perspectives and provided actionable solutions.

**Limitations**

The primary limitation for this study was sample size. The sample sizes for the pre- and posttest surveys during each academic year were relatively low. In both years, the number of students who received the surveys was restricted in order to prevent survey fatigue amongst the student body as a whole. Though approximately 210 students completed CSC each year, only 26 students received the survey in academic year 2022. Though completion rates were high in that academic year, the overall number of survey completions was still relatively small. During academic year 2023, 49 students received the initial survey and completion rates were relatively good. However, the first three surveys (AY22 pretest, AY22 posttest, and AY23 pretest) were conducted by the University and the researcher requested the results as secondary data. The researcher himself conducted the final posttest survey. For the final posttest, the number of recipients was decreased to 38 because the Marine Corps’ survey office did not want
international students to receive a survey from an outside researcher. Moreover, participation rates were much lower, with only 12 completing the final posttest. If the intervention did have an effect, these low numbers increase the probability that the effect was not discovered (type 2 error).

Relatively, the number of theses that were reviewed was relatively low, possibly preventing the discovery of significant differences between the comparison and intervention groups. Theses are the primary means by which students demonstrate their creative problem solving ability at CSC. However, they are also the longest written assignment of the year and they require substantial amounts of time to review. For this reason, CSC never used the theses to evaluate student creativity for its quality enhancement plan. Moreover, requests for faculty to serve as reviewers for this project were met with silence.

As an alternative, colleagues of the researcher, who were serving in the operating forces, completed the thesis rating. The number of raters was small (n=5). They each volunteered to read and rate eight to ten papers, which was about the most that could reasonably be expected of volunteers serving in busy operational billets. In order to attain the highest possible number of theses reviewed (n=44), no interrater reliability was attempted because no thesis was reviewed by more than one rater. Additionally, no training was conducted. In fact, the consensual assessment technique, as Amabile (1982) originally described, stipulates that no training should be conducted—raters should rate creativity according to their own personal standards as subject matter experts. Indeed, having outsider raters can be considered a strength of this research since the raters were serving in operational billets that CSC graduates might one day fill.
Raters currently serving in the operating forces possibly have different standards and understanding of creativity than the faculty at CSC. This problem was partially mitigated through the use of the AAC&U (2009) creativity value rubric. The same rubric was used for MCU’s quality enhancement plan (MCU, 2021a). Overall, 27% of theses were rated as creative or transformative, which is lower than ratings from the previous two academic years (see Table 2.2). However, Table 2.2 also indicates that there was a large jump in scores during academic year 2020, a change which faculty attribute to a change in the prompt for the paper that was rated. From academic year 2017 to academic year 2019, percentages of papers rated as creative or transformative were mostly in the single digits. In any case, CSC never used the theses for the creativity ratings reported as part of the quality enhancement plan. So, determining if the thesis ratings reported in this study reflect substantial differences in the faculty’s opinion of student creativity compared to the ratings of experts currently serving in operational billets in the Fleet Marine Forces is difficult.

Additionally, the present author began this dissertation as a staff member at MCU, working in academic affairs. The author remained on staff during the period of time in which the research he conducted for the first four chapters of this dissertation was completed. However, in July 2022, just prior to the start of the intervention, the author was reassigned to overseas duty for one year. The entirety of the intervention happened while the author was in another country. Some of the interviews also occurred from overseas. In June 2023, the author returned from his year-long overseas tour of duty and assumed a position as a military faculty member in MCU’s College of Distance
Education and Training. This year-long absence was probably a contributing factor to the low sample sizes discussed above and below.

Another issue emerged when trying to recruit students for interviews. Because the study was designed to be an exploratory mixed methods analysis, delays in the survey resulted in delays in the interviews. Survey completion rates were low, so the survey remained open in the hopes that more students would complete it. Once the survey was closed and the quantitative analysis was completed, little time remained in the academic year and few students volunteered for interviews. In the end, only one Marine volunteered for an interview even though 50 percent of the student body were Marines. Conversely, 3 of 5 interviewees were international students even though only about 15 percent of the student body were international students. Finally, three of the five interviewees were top students who had won competitive assignment to a follow-on year at the School of Advanced Warfighting. Only six students from the academic year 2023 class were selected to attend the School of Advanced Warfighting in academic year 2024 and three of them completed interviews. So, the sample for student interviews had a disproportionately small number of Marines and a disproportionately large number of international students and top performers.

Finally, some overlap between the comparison and intervention groups might have occurred. One faculty member served as a seminar facilitator during both academic years and in both the comparison and intervention groups. During academic year 2022, this faculty member began to integrate metacognitive activities into in-class discussions. This faculty members’ primary seminar group represented approximately half of the comparison group. During academic year 2023, this same faculty member’s primary
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seminar group accounted for about one-fourth of the intervention group. However, even though the same faculty member taught in both groups, the academic year 2022 group did not have structured reflection prompts built into the lesson cards and did not benefit from a reduction in the amount of required reading or viewing activity for each lesson. Therefore, though some cross-group contamination might have been present, contamination was likely low.

Discussion

The results of the surveys and the thesis analysis did not support the hypothesized relationships, as described in the logic model (Appendix F) between the intervention and improved metacognition. Additionally, there did not seem to be any relationship between knowledge of cognition, which did not significantly change, and regulation of cognition, which significantly changed in both academic years. Moreover, there was no significant change in the creativity of student theses between academic years 2022 and 2023.

Metacognition

For both the comparison group and the intervention group, there was no significant change in knowledge of cognition or any of its subfactors. Moreover, there were no significant differences between the comparison and intervention groups in knowledge of cognition. The fact that there was no significant change between and amongst groups in knowledge of cognition was somewhat surprising to the faculty and students interviewed. Student participants seemed especially surprised by this finding; stating that they believed their knowledge of cognition had improved. The logic model also hypothesized that changes in knowledge of cognition would lead to changes in regulation of cognition. However, these two factors did not seem to influence each other.
Even more surprisingly, there was a significant decline in the regulation of cognition score for both groups between the pre- and posttest surveys. This decline was bigger in the intervention group than the decline in the comparison group. Moreover, the intervention group showed significant declines in planning learning and monitoring learning. Each of these declines was larger in the intervention group than in the comparison group. The significant decline in regulation of cognition seems odd because regulation of cognition was the key focus of the intervention. Similarly, the subfactors that students exercised the most throughout the year—planning learning and monitoring learning—were the subfactors that showed significant decline.

At first glance, one might assume that these decreases in regulation of cognition reflect that the CSC curriculum has a negative impact on student metacognition, especially since the decline in regulation of cognition occurred in both the comparison and intervention groups. Moreover, there was no significant difference in any measure between academic years, so declines in regulation of cognition seem independent of the intervention. Some possible explanations examine the effect of CSC’s curriculum on survey results.

Most explanations, from both the faculty and students, revolve around the fact that the modified Metacognitive Awareness Inventory is a perception survey (Balcikanli, 2011). The inventory does not measure actual metacognitive ability. Rather, the survey measures participants’ perception of their knowledge of their own cognition and regulation of their own cognition. Therefore, the possibility exists that CSC’s curriculum lowers students’ perceptions of their ability to regulate their thinking, while their actual
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ability is either unchanged or even improved. Indeed, interviewees attested that they believed that student metacognition improved over the academic year.

One explanation for this decline in students’ perception of their own metacognitive ability has to do with the time of the year in which the survey was administered. Especially in academic year 2023, students took the survey during a busy period of the year in which they might have been overwhelmed by the need to complete their theses and get ready to move households soon after graduation. The stress associated with these events might have caused a decline in their perception of their ability to regulate their cognition. Moreover, some students might experience survey fatigue from the multitude of surveys that they complete throughout the year, and these students might not put the same amount of effort into replying to surveys at the end of the year as they did at the start. Multiple students and faculty speculated during their interviews that both end of year stress and survey fatigue might explain the declines reported in the surveys.

Another possibility for explaining declines in student perceptions of their cognitive regulation is the Dunning-Kruger effect (Kruger & Dunning, 1999). One student interviewee referred to a curve in which students’ who are just beginning the year are relative novices and believe that they are very good at regulating their cognition. However, as they learn more and progress through the year, they realize that they were not as good as they originally thought. According to this student’s hypothesis, metacognitive perception scores could be expected to decline throughout the year and then begin to curve upward again at the end of the year. Taking only two snapshots of metacognition perceptions might conceal this curve.
When prompted, other interviewees concurred that this could be a logical explanation. More than one faculty member stated that students “don’t know that they don’t know” at the start of the year. When confronted with their lack of knowledge, their perception of their metacognitive ability decreases. In this case, as with the previous explanations, survey results do not show that students’ real metacognitive ability declined throughout the year, only that their initially overly optimistic perceptions of their metacognitive ability declined.

Another, more negative interpretation, which one student in particular found compelling, was that students observed their lack of effort throughout the year and rated themselves lower at the end of the year than the beginning because they noticed that they were not putting forth as much effort at the end of the year as at the beginning. According to this idea, students were confronted with the task of completing structured reflection exercises. There was no extrinsic motivating factor forcing them to complete these exercises. Therefore, many students did not complete the exercises and were daily reminded, as they looked at the lesson cards, of the fact that they were not engaging in reflective activity. Moreover, the frequency that students skipped the reflective activity probably increased over the academic year. Thus, lower scores on the metacognition survey could reflect some students’ honest assessment that they were not as motivated at the end of the year as they had been at the start.

When asked if they felt that their own adherence to the structured reflection activities had declined over time, some students said that it had or, at least, that their peers’ adherence had declined. Moreover, some faculty reported the same perception of students’ declining responsiveness to the reflective activities. In fact, one faculty member
and one student both particularly questioned the level of motivation of the majority of the students. According to these two participants, the best students continuously completed the activities and continued to grow, but most students did not. The fact that student interviewees tended to be top performers might also shape this explanation of the survey results.

In the end, the main thrust of the intervention during academic year 2023 was regulation of cognition. This was the one area in which students did report a change. The change was not in the anticipated direction, which makes interpretation of the change more difficult. However, it seems improbable that actual metacognitive ability was negatively affected by a year of intensive graduate-level study. In military terms, one might say that CSC targeted regulation of cognition and hit it, but that the effect was not as expected.

**Creativity**

According to the logic model for this study, the structured reflective activities, combined with the increased time to complete them, should have increased the creativity of students’ culminating thesis assignment. Some participants believed that the structured reflection activities did help to provide a foundation for creative thinking. However, none of the participants believed the structured reflection activities would actually have an effect on the creativity of student theses. Most students who were interviewed claimed that their theses were not related to the daily curriculum in which the structured reflection activities were embedded. Faculty argued that structured reflective activities would need to be embedded in the thesis writing process in order for them to have an effect on the creativity of the theses.
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Perhaps, then, it should come as no surprise that there was no significant difference in thesis creativity between the comparison and intervention groups. In both groups, 27 percent of theses were rated as creative or transformative. The sample averages for the intervention group were higher than the sample averages in the comparison group, but these differences were not strong enough to yield a significant result. Perhaps a larger sample of theses might have yielded a significant result. However, the connection between the intervention and the theses remains indirect, at best.

Implications for Practice

As is made clear in the University’s recent strategic plan, MCU and CSC are going to continue to target student metacognitive improvement (MCU, 2022b). For the most part, CSC plans to continue with structured reflective activities on the lesson card and to maintain the reduction in required preparatory reading and viewing—except for the military history courses described by one faculty member. Moreover, though the University’s required quality enhancement plan is complete, the need for professional military educational institutions to foster creative problem solvers and innovative thinkers is not going away. Toward that end, the following recommendations are provided.

The thesis remains the premier outlet for students to demonstrate their creative problem-solving skills during their year of professional military education. During the thesis process, they are more responsible for topic selection, divergent thinking, research, convergent thinking, organization, and analysis than at any other point in the year’s curriculum. CSC should make the connection between the thesis and each day’s curriculum clearer. Additionally, since structured reflection is going to continue, it ought to be a part of the one-on-one thesis mentoring process, not just a part of the daily grind.
Though the needs assessment found that students and faculty generally rated student motivation highly, students’ motivation to engage in structured reflection was questionable. One part of the solution to a lack of student motivation for reflection is to improve the reflective activities. At least some of the reflective prompts are perceived to be “cookie cutter.” If students perceive that relatively little effort went into creating the prompts, then they are likely to exert relatively little effort in completing them. Additionally, some extrinsic motivation, in the form of requiring students to demonstrate that they have completed the activities, might be useful. Reflective journals might be one way in which students can demonstrate their engagement and these journals would have the additional benefit of engaging students to think more clearly by writing out their thoughts.

A strong consensus exists within the professional military education community that military students need opportunities to think creatively, more than just learning and reciting facts. However, the military educational enterprise also has to contend with the effect of military hierarchy upon student creativity. The present study found that appeals to authority can come from many directions, including the military faculty, the civilian faculty, and even some fellow students. Students who advocate for unconventional solutions potentially face greater risk (social and professional) in a military setting than do students in civilian institutions. Professional military educational institutions must make strong and public commitments to academic freedom and diversity of thought if they want to encourage military student creativity.

The leadership at CSC made a reasonably significant change to the curriculum, eliminating about 25% of the preparatory reading, listening, and viewing materials.
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However, no significant change in creative problem solving was observed. This fact suggests that even more change is needed in order to foster student creativity.

Students clearly indicated that the elective curriculum at CSC was the area where they felt that they had the greatest opportunity to think creatively. However, this elective curriculum makes up an extremely small portion of the overall course of study. In order to foster creativity, CSC should re-examine the mix of core and elective courses in the degree program. The Command and Staff College Distance Education Program, part of the University’s non-degree granting College of Distance Education and Training, accomplishes the same student learning outcomes as CSC with vastly fewer contact hours. The resident CSC program should be able to reduce the number of contact hours dedicated to core curriculum and still achieve the necessary student learning outcomes. In exchange, CSC could dramatically expand opportunities for students to explore their own interests via electives.

At the same time, the core curriculum might also be revised to allow students greater freedom to explore and to think creatively. For instance, faculty and students might collaborate in selecting course content. Similarly, students might be given multiple options to explore on assignments or in preparatory reading, listening and viewing activities.

Finally, this study (and MCU’s overall creativity efforts) focuses on individual creativity. There is little emphasis (outside of seminar discussion) on the creativity of groups or teams. This focus on the individual may be overly one dimensional. Perhaps students should have more opportunities to collaborate with faculty on research teams as well as to collaborate with each other. Though increased collaboration generates
increased difficulty in assigning grades to individual students, the payoff might be increased creative problem-solving ability in teams. Rarely will graduates ever be asked to solve problems independently in their future careers, so preparing them to work creatively in teams might be the most important outcome of all.

**Implications for Research**

The most substantial limitation of this study was sample size. Effects of the intervention or interactions of the factors in the needs assessment might have been missed due to this low sample size. The wider professional military education community has a much greater population than that found at MCU. Future iterations of faculty and student surveys developed in the needs assessment might prove useful for other professional military education institutions. Furthermore, if more institutions use these surveys, the chance of finding significant results increases.

Similarly, the metacognition survey for the intervention might not have captured real changes in student metacognitive ability. Future research might examine student metacognition in different ways—ways that focus on actual metacognitive ability and not merely the students’ perceptions of their metacognitive ability. Developing new measures of student metacognitive ability, perhaps aimed by computer-based simulations, is another area of further research.

Within the context at CSC, further research might also consider the effect of more electives or greater research collaboration between students as well as between students and faculty. Moreover, as the College continues to include and improve reflective prompts for students, continuing research might examine how improved prompts lead to improved outcomes. Finally, there is room to evaluate some techniques that might
mitigate the effect of authoritarianism such as creating hierarchy-free zones in the classroom where rank is not worn or asserted.

**Conclusion**

This study examined MCU data going all the way back to academic year 2015 about student creative problem solving at the University. The literature and the fact that MCU prioritized the collection and maintenance of this information demonstrates the near consensus that the United States needs military officers who can solve problems creatively. In order to prioritize this problem, the University made it a part of the quality enhancement plan for its accreditation and wrote it into the strategic plan. Even so, changes to the creative problem-solving ability of MCU students, and CSC students in particular, have been hard to find.

The literature review and the needs assessment for this study established the importance of time. Timing of education during an officer’s career is important, but the amount of time that officers are able to think creatively is also important. CSC is designed to be an opportunity, during the middle of a career, to take a break from operational commitments and think deeply and creatively about national security and the military profession. At the same time, CSC is not merely a break—it is an opportunity to do a different kind of work.

Toward that end, while offering students more time to think, the intervention designed with CSC and studied as part of this dissertation attempted to offer students structure for thinking, rather than merely free time to think. The literature on metacognition and creativity provided ways of building that structure. The Director and
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faculty at CSC took a risk and made an unconventional choice to implement the invention studied here.

As with other efforts at the University that were directed at improving creative problem solving, this study did not find a significant effect on creative problem solving. Moreover, student perceptions of their own ability to regulate their thinking actually decreased during both the comparison and intervention years. Seemingly, CSC did make a change to student perceptions of their own metacognitive ability, but this change was not in the direction expected. Even so, all students and faculty interviewed felt that students experienced real improvements in their metacognitive abilities throughout the academic year.

More research is necessary to examine the relationship between military graduate student perceptions of metacognition and their creativity. Moreover, more work needs to be done to build metacognition into the CSC curriculum as a whole, especially into the thesis writing and mentoring process. The research that CSC students complete at MCU has the potential to lead to significant change in the wider Marine Corps. The time that these students have to think and to create will hopefully provide a strong return on investment during the rest of their careers in service of this nation. The University and the College will continue to seek creative ways to foster student’s creative problem-solving ability.
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## Appendix A

### Figure A.1 AAC&U (2009) Creative Thinking VALUE rubric

<table>
<thead>
<tr>
<th>Score</th>
<th>Transformative - 4</th>
<th>Creative - 3</th>
<th>Adaptive - 2</th>
<th>Imitative - 1</th>
<th>N/A – 0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acquiring Strategies and Skills</strong> (Competency 1)</td>
<td>Reflect: Evaluates creative process and product using domain-appropriate criteria.</td>
<td>Create: Creates an entirely new object, solution or idea that is appropriate to the domain.</td>
<td>Adapt: Successfully adapts an appropriate exemplar to his/her own specifications.</td>
<td>Imitate: Successfully reproduces an appropriate exemplar.</td>
<td>Did Not Demonstrate</td>
</tr>
<tr>
<td><strong>Embracing Contradictions</strong> (Competency 2)</td>
<td>Fully integrates alternate, divergent, or contradictory perspectives or ideas.</td>
<td>Explores alternate, divergent, or contradictory perspectives or ideas.</td>
<td>Includes (recognizes the value of) alternate, divergent, or contradictory perspectives or ideas in a small way.</td>
<td>Acknowledges (mentions in passing) alternate, divergent, or contradictory perspectives or ideas.</td>
<td>Did Not Demonstrate</td>
</tr>
<tr>
<td><strong>Connecting and Synthesizing</strong> (Competency 3)</td>
<td>Transforms ideas or solutions into entirely new forms.</td>
<td>Synthesizes ideas or solutions into a coherent whole.</td>
<td>Connects ideas or solutions in novel ways.</td>
<td>Recognizes existing connections among ideas or solutions.</td>
<td>Did Not Demonstrate</td>
</tr>
<tr>
<td><strong>Innovative Thinking</strong> (Competency 3)</td>
<td>Extends a novel or unique idea, question, format, or product to create new knowledge or knowledge that crosses boundaries.</td>
<td>Creates a novel or unique idea, question, format, or product.</td>
<td>Experiments with creating a novel or unique idea, question, format, or product.</td>
<td>Reformulates a collection of available ideas.</td>
<td>Did Not Demonstrate</td>
</tr>
<tr>
<td>Competency</td>
<td>Description</td>
<td></td>
<td></td>
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<td>------------</td>
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<tr>
<td>Competency 4 (Competency 5)</td>
<td>Develops a logical, consistent plan to solve problem, recognizes consequences of solution, and articulates reason for choosing solution. Proactive in adapting to changing organizational/ unit needs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competency 6</td>
<td>Actively seeks out and follows through on untested and potentially risky directions or approaches to the assignment in the final product. Makes decisions easily under conditions of uncertainty.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Solving Problems**

| Competency 4 (Competency 5) | Develops a logical, consistent plan to solve problem, having selected from among alternatives. Adapts to changing organizational/ unit needs. |
| Competency 6 | Incorporates new directions or approaches to the assignment in the final product. Makes decisions under conditions of uncertainty. |

**Taking Risks**

| Competency 4 (Competency 5) | Considers and rejects less acceptable approaches to solving problem and/or adapting to organizational/ unit needs. |
| Competency 6 | Considers new directions or approaches without going beyond the guidelines of the assignment. Seeks additional guidance before making decisions under conditions of uncertainty. |

**Comments:**
Appendix B

Student Survey (organized by constructs)

Based on your personal experience at Command and Staff College, please indicate your level of agreement or disagreement with the following statements.

Note: Scale is 5 point Likert scale for all questions except the open-ended questions at the end. [strongly agree—somewhat agree—neither agree nor disagree—somewhat disagree—strongly disagree]

Construct: Divergent Thinking

1. Faculty entertain discussion about (or express) controversial opinions in the classroom.
2. I believe that I have academic freedom to say what I think on controversial or sensitive topics.
3. When I receive grades and feedback from the faculty, they place greater emphasis on creative problem-solving than on recalling what was presented in the seminar/lecture/readings.
4. The faculty present students with multiple perspectives on each issue for discussion.
5. The faculty encourage students to express divergent points of view.

Construct: Authoritarianism

6. Maintaining a balance between respect for military authority and creative problem-solving during class discussion is challenging.
7. The faculty encourage me to question authoritative viewpoints in the classroom.
8. Thinking outside the box is something I feel safe doing with senior Military faculty officers at CSC.
9. Military authority at MCU is compatible with divergent thinking.

Construct: Student Knowledge

10. By the time we discuss something in seminar, I know enough about the content covered to think creatively about it.
11. I know how to research questions of interest to me.
12. The breadth of knowledge I need to learn across topics at CSC does not afford me the opportunity to delve deeply into one area.

Construct: Student Opportunity and Motivation

13. The content of Command and Staff College interests me enough to make me want to conduct deeper research.
14. In a given class week, I have enough time to think creatively about specific topics of interest to me.

15. Considering the academic year as a whole, I had sufficient time and opportunity to develop an understanding of meaningful, challenging, problems to the extent that I was able explore and justify creative solutions for those problems.

16. I understand the purpose of critically exploring decisions that the DOD has already made.

17. I want to learn from the experts, not to try to develop my own solutions to problems they know more about.

**Construct: Student Metacognition (directly from Schraw & Dennison, 1994, p. 473-474)**

18. I consider several alternatives to a problem before I answer. (Factor 2; factor loadings:.32; .30)*

19. I ask myself if I have considered all options when solving a problem. (Factor 2; .46; .43)

20. I ask myself if there was an easier way to do things after I finish a task. (Factor 2; .44; .36)

21. I think of several ways to solve a problem and choose the best one. (Factor 2; .60; .63)

22. I focus on the meaning and significance of new information. (Factor 1; .59; .59)

23. I create my own examples to make information more meaningful. (Factor 1; .34; .30)

24. I ask myself if what I'm reading is related to what I already know. (Factor 1; .37; .41)

25. I know what kind of information is most important to learn. (Factor 1; .56; .72)

*For Schraw & Dennison, Factor 1 is Knowledge of Cognition, and factor 2 is Regulation of Cognition. Factor loadings were calculated used two different experiments, so two different loadings are reported.

**Open Ended Questions**

26. If you could make any change to current MCU policies to improve student creative problem-solving, what would it be. Please explain.

27. Please suggest and describe one or two strategies that would help bridge the hierarchical nature of military authority and the non-hierarchical collaborative nature of student creative problem-solving.
Appendix C

Faculty Survey (organized by constructs)

Based on your personal experience at Command and Staff College, please indicate your level of agreement or disagreement with the following statements.

Please restrict your responses to your experiences at CSC (resident program), and do not take into account your experiences at other MCU schools/colleges.

Note: Scale is 5 point Likert scale for all questions except the open-ended questions at the end. [strongly agree—somewhat agree—neither agree nor disagree—somewhat disagree—strongly disagree]

**Construct: Divergent Thinking**

1. I believe that I have academic freedom to express controversial opinions in the classroom.
2. Students believe they have the freedom to express controversial opinions in the classroom.
3. In assigning grades to students, I place greater emphasis on creative problem-solving than on recalling what students have learned in class/lecture/the readings.
4. The curriculum presents students with multiple perspectives on each issue for discussion.
5. I encourage students to express divergent points of view.

**Construct: Authoritarianism**

6. Maintaining a balance between respect for military authority and creative problem-solving during class discussion is challenging.
7. In class discussion, students are influenced by appeals to authority.
8. I incorporate specific strategies in class to encourage students to question authority safely.
9. Military authority at MCU is compatible with divergent thinking.

**Construct: Student Knowledge**

10. Students have sufficient subject matter expertise to think creatively in the subject area.
11. Students have sufficient understanding of the research tools necessary to examine problems creatively.
12. Students thoroughly complete prep work prior to the seminar (e.g. readings).
13. Too much time is required to ensure students have enough general knowledge to allow for a deeper examination of any one particular issue.
Construct: Student Opportunity and Motivation

14. Students are generally interested enough in the CSC curriculum to want to conduct deeper research.

15. In any given class week, students generally have enough time to think creatively about specific topics that interest them.

16. Considering the academic year as a whole, students have sufficient time and opportunity to develop an understanding of meaningful, challenging, problems to the extent that they are able explore and justify creative solutions for those problems.

17. Students understand the purpose of critically discussing things the DOD has already decided.

18. Students would prefer to be given experts solutions rather than having to develop them on their own.

Open Ended Questions

19. If you could make any change to current MCU policies to improve student creative problem-solving, what would it be. Please explain.

20. Please suggest and describe one or two strategies that would help bridge the hierarchical nature of military authority and the non-hierarchical collaborative nature of student creative problem-solving.
### Appendix D

**Regressions to support data in Table 2.7**

#### Table D.1 Multiple Linear Regression with dependent variable: 3100B essay (n=27)

<table>
<thead>
<tr>
<th></th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.557</td>
<td>0.311</td>
<td>0.057</td>
<td>0.0314</td>
</tr>
</tbody>
</table>

#### ANOVA

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>7</td>
<td>0.001</td>
<td>1.223</td>
<td>.338</td>
</tr>
<tr>
<td>Residual</td>
<td>19</td>
<td>0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>0.027</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Unstandardized Coefficients

<table>
<thead>
<tr>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>Sig.</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>1.018</td>
<td>0.09</td>
<td>11.317</td>
<td>0</td>
<td>0.862</td>
<td>1.174</td>
</tr>
<tr>
<td>Divergent Thinking</td>
<td>-0.013</td>
<td>0.011</td>
<td>-0.34</td>
<td>-1.227</td>
<td>0.235</td>
<td>-0.033</td>
</tr>
<tr>
<td>Authoritarianism</td>
<td>-0.016</td>
<td>0.01</td>
<td>-0.401</td>
<td>-1.488</td>
<td>0.153</td>
<td>-0.034</td>
</tr>
<tr>
<td>Student Knowledge</td>
<td>0.01</td>
<td>0.009</td>
<td>0.276</td>
<td>1.115</td>
<td>0.279</td>
<td>-0.005</td>
</tr>
<tr>
<td>Time and Opportunity</td>
<td>-0.019</td>
<td>0.008</td>
<td>-0.589</td>
<td>-2.433</td>
<td>0.025**</td>
<td>-0.032</td>
</tr>
<tr>
<td>Motivation</td>
<td>0.002</td>
<td>0.012</td>
<td>0.044</td>
<td>0.167</td>
<td>0.869</td>
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</tr>
<tr>
<td>Knowledge of cognition</td>
<td>0.004</td>
<td>0.015</td>
<td>0.055</td>
<td>0.257</td>
<td>0.8</td>
<td>-0.022</td>
</tr>
<tr>
<td>Regulation of cognition</td>
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<td>0.016</td>
<td>-0.098</td>
<td>-0.39</td>
<td>0.701</td>
<td>-0.033</td>
</tr>
</tbody>
</table>

* *p < .1; ** p < .05
Table D.2 Multiple Linear Regression with dependent variable: 4100B essay (n=27)

<table>
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<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>.549</td>
<td>0.301</td>
<td>0.044</td>
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ANOVA

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<tr>
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<th>df</th>
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<th>F</th>
<th>Sig.</th>
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</thead>
<tbody>
<tr>
<td>Regression</td>
<td>0.01</td>
<td>7</td>
<td>0.001</td>
<td>1.17</td>
</tr>
<tr>
<td>Residual</td>
<td>0.023</td>
<td>19</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0.033</td>
<td>26</td>
<td></td>
<td></td>
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<table>
<thead>
<tr>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>90.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
</tr>
<tr>
<td>(Constant)</td>
<td>1.086</td>
<td>0.099</td>
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<tr>
<td>Divergent Thinking</td>
<td>-0.004</td>
<td>0.012</td>
</tr>
<tr>
<td>Authoritarianism</td>
<td>-0.015</td>
<td>0.012</td>
</tr>
<tr>
<td>Student Knowledge</td>
<td>-0.005</td>
<td>0.009</td>
</tr>
<tr>
<td>Time and Opportunity</td>
<td>-0.015</td>
<td>0.008</td>
</tr>
<tr>
<td>Motivation</td>
<td>0.007</td>
<td>0.013</td>
</tr>
<tr>
<td>Knowledge of cognition</td>
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<td>0.017</td>
</tr>
<tr>
<td>Regulation of cognition</td>
<td>-0.011</td>
<td>0.017</td>
</tr>
</tbody>
</table>

*p < .1; ** p < .05
Table D.3 Multiple Linear Regression with dependent variable: GPA (n=27)

<table>
<thead>
<tr>
<th>R</th>
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<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>.556</td>
<td>0.309</td>
<td>0.054</td>
<td>0.2001</td>
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</tbody>
</table>

ANOVA

<table>
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<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>0.34</td>
<td>7</td>
<td>0.049</td>
<td>1.212</td>
</tr>
<tr>
<td>Residual</td>
<td>0.761</td>
<td>19</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1.1</td>
<td>26</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Unstandardized Coefficients

<table>
<thead>
<tr>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>t</th>
<th>Sig.</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
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<tr>
<td>Divergent Thinking</td>
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<td>0.07</td>
<td>-0.295</td>
<td>-1.065</td>
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<td>-0.196</td>
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<tr>
<td>Authoritarianism</td>
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<td>0.067</td>
<td>-0.468</td>
<td>-1.735</td>
<td>0.099*</td>
<td>-0.231</td>
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<tr>
<td>Student Knowledge</td>
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<td>0.054</td>
<td>0.232</td>
<td>0.936</td>
<td>0.361</td>
<td>-0.043</td>
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<tr>
<td>Time and Opportunity</td>
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<td>-0.305</td>
<td>-1.256</td>
<td>0.224</td>
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<tr>
<td>Motivation</td>
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<td>-0.553</td>
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<tr>
<td>Knowledge of cognition</td>
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<td>0.095</td>
<td>-0.051</td>
<td>-0.238</td>
<td>0.814</td>
<td>-0.188</td>
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<tr>
<td>Regulation of cognition</td>
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<td>0.099</td>
<td>-0.358</td>
<td>-1.42</td>
<td>0.172</td>
<td>-0.312</td>
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</tbody>
</table>

*p < .1; ** p < .05
Table D.4 Multiple Linear Regression with dependent variable: QEP assessment (n=16)

<table>
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<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.735</td>
<td>0.54</td>
<td>0.137</td>
<td>0.60701</td>
</tr>
</tbody>
</table>

ANOVA

<table>
<thead>
<tr>
<th>Sum of Square</th>
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<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regressio n</td>
<td>7</td>
<td>0.494</td>
<td>1.34</td>
<td>.343</td>
</tr>
<tr>
<td>Residual</td>
<td>8</td>
<td>0.368</td>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficient</th>
<th>90.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
</tr>
<tr>
<td>(Constant)</td>
<td>6.508</td>
<td>2.171</td>
</tr>
<tr>
<td>Divergent Thinking</td>
<td>0.184</td>
<td>0.284</td>
</tr>
<tr>
<td>Authoritarianism</td>
<td>-0.702</td>
<td>0.337</td>
</tr>
<tr>
<td>Student Knowledge</td>
<td>-0.082</td>
<td>0.265</td>
</tr>
<tr>
<td>Time and Opportunity</td>
<td>-0.571</td>
<td>0.324</td>
</tr>
<tr>
<td>Motivation</td>
<td>-0.002</td>
<td>0.308</td>
</tr>
<tr>
<td>Knowledge of cognition</td>
<td>0.48</td>
<td>0.507</td>
</tr>
<tr>
<td>Regulation of cognition</td>
<td>-0.841</td>
<td>0.362</td>
</tr>
</tbody>
</table>

*p < .1; ** p < .05
Appendix E

Figure E.1 Studies examining the relationship between metacognition and creativity

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Measures</th>
<th>Tasks</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carson et al., 2017</td>
<td>37 cadets at a Norwegian undergraduate defense academy</td>
<td>Reflection, self-regulation, and metacognition</td>
<td>Multiple tasks</td>
<td>Reflection, self-regulation, and metacognition are positively associated with measures of cognitive agility.</td>
</tr>
<tr>
<td>Knox et al., 2019</td>
<td>20 native Chinese speakers at a University</td>
<td>Alternative uses task, EEG to measure alpha synchronization, reflection task, distraction task</td>
<td></td>
<td>Students who completed the reflection task (vs. the distraction task) showed greater creativity and higher alpha synchronization.</td>
</tr>
<tr>
<td>Lafond et al., 2012a; Lafond et al., 2012b</td>
<td>32 Canadian Naval personnel</td>
<td>Complex decision making intervention</td>
<td></td>
<td>No link between metacognition and scenario success, but some information-seeking behaviors were correlated with success.</td>
</tr>
<tr>
<td>Hao et al., 2016</td>
<td>20 native Chinese speakers at a University</td>
<td>Alternative uses task, EEG to measure alpha synchronization, reflection task, distraction task</td>
<td></td>
<td>Students who completed the reflection task (vs. the distraction task) showed greater creativity and higher alpha synchronization.</td>
</tr>
<tr>
<td>Cantwell et al., 2017</td>
<td>PhD students at Australian universities (n=1390)</td>
<td>Reaction to daily events questionnaire; doctoral efficacy questionnaire; need for cognition questionnaire; metacognitive awareness inventory; epistemological beliefs questionnaire; academic volition control inventory; doctoral responsibility questionnaire; procrastination inventory</td>
<td></td>
<td>Doctoral candidates did present as elite. Students clustered into three groups: constructively engaged, struggling to engage, disengage.</td>
</tr>
<tr>
<td>Carson, 2012</td>
<td>30 English majors at a Japanese university</td>
<td>Independent learning task; Verbal Protocol Analysis</td>
<td></td>
<td>Frequent movements between thinking about content and meta-cognition.</td>
</tr>
<tr>
<td>1. Does doctora l candidates present with a metacognitive profile consistent with expectations of an elite cohort of students?</td>
<td>2. Is there significant variation in metacognitive profile across this cohort?</td>
<td>3. What relationships exist between self-reported metacognitive profile and other cognitive abilities and performance?</td>
<td></td>
<td>1. Doctoral candidates did present as elite. Students clustered into three groups: constructively engaged, struggling to engage, disengage. 2. 3. With respect to the relationship between self-reported metacognitive profile and other cognitive abilities and performance.</td>
</tr>
</tbody>
</table>

Note: The table provides a summary of the studies examining the relationship between metacognition and creativity.
<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Methods</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kudesia et al., 2015</td>
<td>111 postgraduate dentistry students</td>
<td>Mind wandering leads to local search; metacognitive reflection leads to distant search.</td>
<td></td>
</tr>
<tr>
<td>Lloret et al., 2003</td>
<td>18 graduate-level dentistry students</td>
<td>Students’ epidemiological knowledge improved, but their scores on self-regulation decrease. However, qualitative analysis showed what metacognitive behaviors students most frequently displayed.</td>
<td></td>
</tr>
<tr>
<td>Pelton, 2019</td>
<td>115 mostly undergraduate sociology students</td>
<td>Direct classroom instruction on metacognition. Motivated strategies for Learning Questionnaire showed significant differences in motivation, use of metacognition, elaboration, organization, and critical thinking, but no difference between control and intervention.</td>
<td></td>
</tr>
<tr>
<td>Shay et al., 2020</td>
<td>112 USMA engineering undergraduates</td>
<td>Students completed work more quickly, had better team cohesion, and won more external awards.</td>
<td></td>
</tr>
<tr>
<td>Yeh et al., 2020</td>
<td>149 undergraduate students in Taiwan</td>
<td>Smartphone-based mindfulness tasks; beliefs toward mobile devices for creativity learning questionnaire, inventory of creativity self-efficacy; smartphone-based mindfulness tasks; qualitative analysis of verbalized metacognition.</td>
<td>Participants become more in-tune with their surroundings post-intervention. Students in the treatment group had greater improvements in creative self-efficacy than students in the control.</td>
</tr>
</tbody>
</table>
## Context

- Marine Corps University’s (MCU) quality enhancement plan focuses on strengthening leadership through creative problem solving.
- Needs assessment indicates that students need more time to reflect.
- MCU Strategic Plan includes task to enhance students’ metacognitive skills.
- Students complete master’s theses in order to earn a degree.
- Military context can is hierarchical and some students and/or faculty can be authoritarian, negatively impacting creative thinking.

## Processes

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Activities</th>
<th>Outputs</th>
<th>Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate students organized into 16 “conference groups” of approx. 12 students each.</td>
<td>- Foundational lectures and seminar to introduce metacognition and students’ knowledge of cognition.</td>
<td>- MCU faculty assigned as thesis mentors.</td>
<td></td>
</tr>
<tr>
<td>Faculty council chair tasked with developing structured reflection opportunities for students.</td>
<td>- Students reflect individually and in conference groups.</td>
<td>- MCU faculty assigned to each conference group.</td>
<td></td>
</tr>
<tr>
<td>Reduced required pages of reading for each day.</td>
<td>- Opportunity for students to reflect on their work with advisors.</td>
<td>- MCU course directors design prompts with guidance from faculty council chair.</td>
<td></td>
</tr>
<tr>
<td>Time for reflection built into schedule, which is relatively highly structured.</td>
<td>- Faculty council chair builds faculty development plan.</td>
<td>- Students in conference groups.</td>
<td></td>
</tr>
<tr>
<td>Thesis advisors play a critical role in encouraging creativity.</td>
<td>- Structured reflections focus on regulation of cognition in the learning process before, during, and after learning.</td>
<td>- MCU faculty participating in mandatory faculty development program.</td>
<td></td>
</tr>
</tbody>
</table>

## Participation

- MCU faculty mentors.
- MCU faculty assigned to each conference group.
- MCU course directors design prompts with guidance from faculty council chair.
- Students in conference groups.
- MCU faculty participating in mandatory faculty development program.

## External Factors

- Accomplishment of final two distal outcomes exceeds timeline of evaluation.
- Student growth unrelated to intervention.

## Assumptions

- Faculty will implement intervention with fidelity.
- Intervention will be sufficiently different from current practice that it will show an effect.

## Outcomes

<table>
<thead>
<tr>
<th>Short-Term</th>
<th>Intermediate</th>
<th>Distal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase to the amount of time that students reflect on their work.</td>
<td>Greater metacognitive regulation before, during and after learning.</td>
<td>More creative theses.</td>
</tr>
<tr>
<td>Students increase knowledge of cognition, including bias and authoritarianism.</td>
<td>Increase to creative problem-solving in mid-year electives.</td>
<td>More theses published in journals and winning awards.</td>
</tr>
<tr>
<td>Students make connections back, across, outside and ahead.</td>
<td></td>
<td>Graduates demonstrate creative problem-solving ability in future jobs.</td>
</tr>
</tbody>
</table>

---

**Figure F.1 Logic Model**

<table>
<thead>
<tr>
<th>Context</th>
<th>Processes</th>
<th>Outcomes</th>
<th>Assumptions</th>
<th>External Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCU faculty mentors.</td>
<td>- MCU faculty assigned to each conference group.</td>
<td>- MCU faculty participating in mandatory faculty development program.</td>
<td>- Faculty will implement intervention with fidelity.</td>
<td>- Accomplishment of final two distal outcomes exceeds timeline of evaluation.</td>
</tr>
<tr>
<td>MCU course directors design prompts with guidance from faculty council chair.</td>
<td>- Students in conference groups.</td>
<td>- Students in conference groups.</td>
<td>- Intervention will be sufficiently different from current practice that it will show an effect.</td>
<td>- Student growth unrelated to intervention.</td>
</tr>
</tbody>
</table>
## Appendix G

### Figure G.1 Outcome Evaluation Matrix

<table>
<thead>
<tr>
<th>Outcome Evaluation Question</th>
<th>Construct</th>
<th>Data Sources</th>
<th>Data Collection Tool</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do students in the intervention group show greater growth in metacognition than students in the comparison group?</td>
<td>Metacognition (divided into knowledge of cognition and regulation of cognition)</td>
<td>Students</td>
<td>Metacognitive Awareness Inventory (Balcikanli, 2011; Schraw &amp; Dennison, 1994)</td>
<td>Pretests (Sept); posttests (AY22: Dec; AY23: May)</td>
</tr>
<tr>
<td>Do students in the intervention group demonstrate greater creative problem-solving ability on select student products than students in the comparison group?</td>
<td>Creative Problem Solving</td>
<td>Students: final theses</td>
<td>Consensual assessment technique (Amabile, 1982) using the AAC&amp;U (2009) Creativity value rubric.</td>
<td>End of academic year</td>
</tr>
<tr>
<td>How do students and faculty describe the ways that the intervention impacted student metacognitive ability and creative problem-solving ability?</td>
<td>Structured Reflection, Time</td>
<td>Interviews (Students and Faculty); Open-ended response items.</td>
<td>Open-ended survey questions; Interviews</td>
<td>Survey (April/May); Interviews (June-Sept)</td>
</tr>
</tbody>
</table>
Appendix H

Modified Metacognitive Awareness Inventory (Balcikanli, 2011)

1. I use my strengths to compensate for my weaknesses in my learning
2. I can motivate myself to learn when I really need to learn
3. I use different learning strategies depending on the situation
4. I know when each learning strategy I use will be most effective
5. I am aware of the strengths and weaknesses in my thinking and learning
6. I know what skills are most important in order to be a good learner
7. I have control over how well I learn
8. I know what I am expected to learn
9. I ask myself how well I have accomplished my learning goals once I am finished
10. I ask myself if I could have used different strategies after each learning experience
11. After learning a point, I ask myself if I could have learned it more effectively using a different strategy
12. I ask myself if I have considered all possible strategies after learning a point
13. I try to use learning strategies that worked in the past
14. I have a specific reason for choosing each learning strategy I use in my classes
15. I am aware of what strategies I use while I am learning
16. I use helpful learning strategies automatically
17. I pace myself while I am learning in order to have enough time
18. I set my specific learning goals before I start learning
19. I ask myself questions about the materials I am going to use to learn
20. I organize my time to best accomplish my learning goals
21. I ask myself periodically if I meet my learning goals while I am learning
22. I find myself assessing how useful my learning strategies are while I am learning
23. I check regularly to what extent I comprehend the topic while I am learning
24. I ask myself questions about how well I am doing while I am learning

Open-ended questions appended to AY23 posttest only:
1. Lesson cards for each seminar discussion included structured reflection prompts for before, during and after the seminar. Did you find these prompts useful for thinking creatively about CSC content or about your thesis? Please explain.

2. Command and Staff College reduced the amount of reading required in preparation for each seminar. Did you feel that you had enough time to reflect about the reading content and/or to think creatively about it? Did you feel that there was enough reading material to prepare you for discussions? Please explain.
Appendix I

Figure I.1 Process evaluation data collection matrix

<table>
<thead>
<tr>
<th>Process Evaluation Question</th>
<th>Process Evaluation Indicator(s)</th>
<th>Data Source(s)</th>
<th>Data Collection Tool</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>To what extent did faculty follow curriculum guidelines?</td>
<td>Fidelity of implementation-adherence (Dusenbury et al., 2003), Frequency of use, Reinvention</td>
<td>Faculty, Students</td>
<td>Interviews</td>
<td>End of year</td>
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<td>To what extent did faculty feel that the new curriculum met their needs?</td>
<td>Fidelity of implementation-quality of program delivery (Dusenbury et al., 2003) Effectiveness; Modification</td>
<td>Faculty, Students</td>
<td>Interviews</td>
<td>End of year</td>
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<tr>
<td>How much effort did students put into intervention activities?</td>
<td>Participant responsiveness (Dusenbury et al., 2003) Effort</td>
<td>Students, Faculty</td>
<td>Open ended survey questions, interviews</td>
<td>End of year</td>
</tr>
</tbody>
</table>
Appendix J

Semi-structured Faculty Interview Protocol

Participants will be solicited directly by me and by the Faculty Council Chair at MCU.

Interviews will be recorded if participant grants permission. I will take notes.

Send email to participant with oral interview consent.

Read oral interview consent and allow participant time to ask questions.

Introduce Problem of Practice and purpose of the interview.

Questions about Program Differentiation
1. How, if at all, did structured reflection prompts change your teaching practice?
2. To what degree would you say that this year’s curriculum varied from last years, especially with respect to the reflection prompts?
3. Did this variation impact your teaching or the discussion time in the conference groups?

Questions about Adherence
1. To what extent did you follow the lesson cards?
2. To what extent did you use the provided reflection prompts in seminar discussion? How often did you use the prompts?
3. Did your adherence to the structured reflection prompts change as the semester went on?

Questions about Participant responsiveness
1. Do you think that students honored the purpose of the pre-seminar reflection questions? For example, did they spend a full hour on reflection each night? What proportion of students do you think completed the reflections before each seminar?
2. Did students mention in discussion that they had reflected on the provided prompts?
3. Did the students’ adherence to the reflection activities change as the semester went on?

Questions about Quality of Delivery
1. Did you find the structured reflection questions useful?
2. Did you feel the need to modify the structured reflection questions for the students (either in seminar discussion or in preparation)?
3. Did the quality of the questions change as the semester went on?

Questions about Outcomes
1. Did you notice any differences in the quality of student participation due to the fact that students were required to do less reading?
2. Did you notice any differences in the quality of student participation due to the fact that students engaged in pre-seminar reflection?
3. How do you think the structured reflection activities impacted student creativity?
4. How do you think the reduction in required reading impacted student creativity?
5. If metacognition survey results were not significantly different (better or worse) last year’s results, would you be surprised and how would you explain this?
6. If the creativity of student theses were significantly different (more or less creative) from last year’s, would you be surprised and how would you explain this?
7. If you served as a thesis advisor both last year and this year, have you noticed any differences in student preparation or thesis assignments so far that you might attribute to the structured reflection activities?
Appendix K

Semi-structured Student Interview Protocol

Participants will be solicited directly by me and by the Faculty Council Chair at MCU.

Interviews will be recorded if participant grants permission. I will take notes.

Send email to participant with interview consent.

Read oral interview consent and allow participant time to ask questions.

Introduce Problem of Practice and purpose of the interview.

Questions about Quality of Delivery
1. Did faculty use reflection questions from the lesson cards in seminar discussion?
2. Did the quality of the questions change as the semester went on?
3. How valuable were the readings?
4. Were the readings too much or too little?

Questions about Participant responsiveness
1. Did you honor the purpose of the pre-seminar reflection questions? For example, did you spend a full hour on reflection each night? How often do you think completed the reflections before each seminar? What about your peers?
2. Did your adherence to the reflection activities change as the semester went on (i.e. did you spend more time on reflection early in the semester)? What about your peers?

Questions about Outcomes
1. Did you find the structured reflection questions useful for thinking creatively about the topics of the seminar? About your thesis?
2. In general, did you feel that you had enough time to think creatively about CSC content?
3. Did you find the structured reflection questions useful for…
   a. planning your learning (e.g. planning for assignments or the thesis)?
   b. monitoring your learning (i.e. monitoring how well you understood the content)?
   c. evaluating your learning (thinking about the quality of your work)
   d. thinking back or ahead to related CSC content or your time in the Fleet Marine Forces?

Questions about Survey results
If you completed the survey:
1. We sent the survey to students twice this year. Some questions were designed to try to figure out how much students know, or perceive that they know, about how they learn. On average, we found no significant change in how students perceived their knowledge of how they learn. Does this surprise you? How would you explain these results?
2. Other questions were designed to figure out how students perceived that they self-regulated their own learning (for instance, planning their learning, monitoring how well they were learning, and evaluating how well they learned something). On average, we found that students reported significantly lower scores on self-regulation of their own learning when comparing the start of the academic year to the end. Does this surprise you? How would you explain this?

3. Did you find it redundant to take the survey twice? When completing the survey the second time, did you remember your answers (or your feeling about the questions) from the first time you completed the survey? If so, did your feelings about the survey or some of the questions change from the start of the academic year to the end?

4. If your answers or general thoughts about the survey questions changed from the start of the academic year to the end: Thinking back to how you answered the survey questions each time, did your self-regulation of your own learning change? Or did your answers change because your satisfaction with your self-regulation of your own learning changed?

5. Did your responses change based on the context of your learning? For instance, were your responses different at the start of the academic year because you were thinking of other learning contexts and then at the end of the year, you were thinking specifically about CSC? If so, could you describe this difference?

6. Were the questions appropriate? Did they make any intentional or unintentional assumptions about students at CSC that were incorrect?

7. Was the survey an appropriate length?

8. Were any of the questions confusing or ambiguous in their wording or reference?