

THE IMPACT OF ONLINE DISCUSSION ON CAPSTONE QUALITY  
OF STEM EDUCATORS

by

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## ABSTRACT

Due to the advent of online education and professional credentialing, this action research study investigates the impact of online discussion on capstone quality produced by twenty graduated students of the Montana State University MSSE program in Fall 2015. Individuals' online posts and capstones were assessed and analyzed for correlation. Student attitudes and factors influencing online discussion were also investigated via online surveys and personal interviews. Quantitative results show there is correlation between online discussion post quality and capstone quality. Common factors influencing online discussion behavior surround lack of a mobile D2L platform, ability to do topical searches, social network features, Internet connectivity and perception of low-quality conversation of peers. The knowledge gained in this project illuminates the path through which better online learning and discussion platforms may be crafted and utilized in K-12, post-secondary and professional institutions.

## INTRODUCTION AND BACKGROUND

As an international science and music educator of nearly ten years, I have experienced the tectonic pressures our industry is currently under, the winds of globalized education and trade pressing its sails towards technological adoption. Robust budgets, premium tuition costs and ever more intense competition for students has put administrators and teaching faculty under greater pressure to find and adopt “cutting edge” instructional methods, particularly those involving digital tools. Further, as institutions of multi-cultural learning are strewn across the globe, there is a prescient necessity for students and faculty to shirk the limits of geography and time, seeking out peers and mentors, information and professional development online. Fervent in our quest, however, there is a lack of collective wisdom, no sages with hindsight-rich knowledge to instruct as to how best navigate this new virtual ocean. In our youth in this new medium, armed with lengthy memory of intimate personal discourse in idea-fertile classrooms and the best of intentions, education has fashioned as close an approximation of this historical method of educational conversation as it currently can: online discussion. This project seeks to investigate whether the current practice of online discussion is indeed beneficial to student outcomes in an online course.

In order to allow student interaction and dissemination of ideas akin to that in campus-based classes, Montana State University’s Masters of Science in Science Education program’s (MSSE) online courses require its students to engage in asynchronous online discussion. Students log in to an online course platform (Desire 2 Learn) and engage in a variety of online discussion behaviors including initiating a thread

(starting a conversation), posting a reply (responding to another student's post), or reading the posts of others. Generally, MSSE courses require students to produce a minimum of 5 online discussion behaviors (thread initiations and replies) each week for 12 weeks. All written student online discussion behaviors are recorded by the D2L platform for assessment and utilization by others. Through online platforms, students design an action research project on a topic of relevance to their teaching situation, culminating in a final capstone project presented at the terminus of the program.

The volume and type of online discussion posts made by twenty individuals were tracked and analyzed for relationships between discussion and their correlation to long-term student achievement, represented via final capstone quality assessed via the same standards applied by adjudicating MSSE faculty. Further, student attitudes towards online discussion and factors influencing their online discussion were surveyed to illuminate student perceptions of online discussion and its relationship to quality capstone production as well as potential insight into future changes to the expectations and execution of online discussion programs.

### Research Questions

The primary research question of this study was: what is the impact of online discussion on capstone quality?

Sub-questions are:

1. How does the type of post (thread initiation/ reply) correlate to capstone quality?
2. How does quality of post correlate to capstone quality?

3. How are student attitudes towards online discussion correlated to academic achievement?
4. What are some factors impacting online discussion behavior?

## CONCEPTUAL FRAMEWORK

### Online Discussion and Academic Achievement

“It becomes increasingly important to ensure that these distance programs are delivered in ways that provide effective learning experiences for the students enrolled” (Strizich, 2010, p. 2). As part of Montana State University’s distance education programs, MSSE capstones are developed and refined via online courses (EDCI 505, 509, and 575). Strizich conducted a study assessing distance education programs in the Montana State University system and interviewed leaders of a diversity of MSU distance programs for input on current practices and opinions on distance program assessment. Concerning the specific assessment of discussion activities required of students in MSU distance programs, the study found that indeed discussion activities are a valuable practice as “there is opportunity for greater feedback to students both from the instructor and from other students” (p. 37). Thomas (2002) found that “online discussion forums promoted high levels of cognitive engagement and critical thinking,” (p. 361) two skills that aid the development of quality capstones and that are developed in MSSE online education courses.

Researching the efficacy of online discussion as a means for peers to communicate and learn as in face-to-face discussion, Palmer, Holt, and Bray (2008) studied 86 students enrolled in a wholly online second-year engineering

management/professional practice study unit at Deakin University, Australia. Palmer et al. found that while many students read others' posts extensively, the number of posts and replies made were generally at the minimum level required to receive full marks. He further found that two factors most impacted students' overall achievement – prior academic ability and the number of *new* posts (thread initiations) made online.

On a diverse mix of 67 participants from a small Hawaiian liberal arts university enrolled in different psychology courses, Ramos (2008) studied the difference in influence between “hits” (access of course materials), discussion posts, and “reads” as predictors of student success in an online course. Of the three predictors, the number of hits was the only behavior found to serve as an indicator of student success, and a quite reliable one. Ramos (2008) did not articulate whether “new” versus “reply” posts was differentiated in the discussion post analysis.

#### Factors influencing online discussion

When considering the efficacy of an instructional method, it is worth considering user attitudes towards the method to gain qualitative insight into trends in user behavior. Drennan, Kennedy and Pisarski, (2005) investigated factors influencing student attitudes towards online learning management systems among first-year undergraduate students in an introductory management course. They found two key factors that attributed to student satisfaction: positive perceptions of technology in terms of ease of use and accessibility, and autonomous, innovative learning styles ( $N=248$ ). Summers, Waigandt and Whittaker (2005) compared two dimensions from an online distance course and traditional classroom learning in an undergraduate statistics course: final grades and student

satisfaction. They found that students were significantly less satisfied with the online course than the traditional classroom setting due to several potential factors outlined in their conclusion. The online and classroom courses were only different in their content delivery medium – one course was delivered via the Internet and one in a traditional classroom. It would seem the lack of real-time discussion online was a significant factor in student dissatisfaction within the course. The authors noted that in future iterations of the course, they would adapt several online course features concerning structure and communications between instructors and peers, not limited to real-time, synchronous online discussion to generate greater interaction within the online setting.

Specifically investigating student attitudes and perceptions in asynchronous online discussion of 35 undergraduate and graduate students, Pena-Shaff, Altman, and Stephenson (2005) found that while student attitudes about computers and online learning were not correlated to participation levels and perceptions of learning in online courses, “there were significant intercorrelations between pre-course attitudes, expectations about bulletin-board systems (BBS) used for class discussions, and expected learning.” (p. 420) Further, greater participation engendered greater satisfaction. Inspired by these insights, this author wishes to further inquire whether student attitudes towards online discussion ultimately express themselves via a correlation between student attitudes, actual online discussion behavior and overall academic achievement.

Beyond looking at student attitudes and perceptions of online learning, there is a new, technological field of study relevant to education: Behavioral Design. It centers on the research and behavioral model of Dr. BJ Fogg of Stanford University, who

summarized BD as where “motivation, ability and triggers converge” (Cheng, 2010). In an effort to nurture solutions in a wide array of fields from health to marketing, behavioral design focuses on the intersection of individual factors, such as motivation and technological factors, and including design simplicity and prompting of the user to beget desired outcomes. From the Stanford Behavior Design (BD) homepage, “Designing for behavior change via social and mobile tech is new, with no leading books or conferences to provide guidance. Our goal is to explain human nature clearly and map those insights onto the emerging opportunities in technology” (Fogg, 2017). BD seeks to understand not only human nature and tendencies, but also how best to design technologies to reduce obstacles and maximize simplicity of use, allowing full expression of the user’s desires, motivations and goals. While many see applications of BD merely in marketing and other fiscal redistribution, the author of this study, along with founder BJ Fogg, envisions the possibilities for BD to not only improve digitized education, but open avenues of human collaboration and achievement previously unseen.

Given the similarities between social media platforms (mass digital communication spaces) and Learning Managements Systems (LMS) that are utilized in online education, it is pertinent to draw insights from BD into possible relevance for LMSs and online discussion in particular. In a two-minute video, *Design for Behavior Change*, Dr. Fogg briefly answers a question on why some users are more consistent than others engaging online interfaces such as Facebook. In order of impact on yielding desired outcomes, one should first investigate if the user is triggered sufficiently (through notifications or email notices), then if they possess the ability to engage more often

(considerations such as time, interface simplicity, and technological fluency), and finally, if the user is motivated to engage.

As an example of a specific technological feature's influence on online behavior, Fogg (December 19, 2008) describes in a 60-second video from his blog, *Psychology of Facebook*, how commenting is the "secret sauce" to all social media. Without commenting, people would not post or interact, and "everything [the liveliness of online engagement] would fall apart." "Any comment is rewarding," says Dr. Fogg who goes on to give advice to viewers, regardless of quality, to comment in any way possible on others' posts so as to "strengthen that relationship [between commenter and comment recipient]." Another specific example of the impact of commonly utilized digital platform features are "triggers" or prompts. Cheng (2010) describes how advertisement integration in Facebook feeds has adapted over the years, driven by the intersection of motivations and triggers. In early 2010, Facebook started integrating general advertisements into Facebook feeds, garnering harsh backlash from users; these triggers were initially seen as an annoyance. Quickly adapting, Facebook removed the advertisements and created business pages, allowing users to "follow" businesses of their choice. Through these pages, businesses could then post advertisements and updates. While formatted similarly and appearing in the same location as previous advertisements, the adapted advertisement triggers garnered no resistance from users. The key distinction was the motivation of the user, expressed in their subscription to a business's page. Without that motivation, triggers yielded negative reactions, the opposite desired outcome of advertisements. The considerations of motivation, ability, and triggers are key to the Fogg Behavioral Model,

and this author believes also has strong relevance to online discussion and LMS design.

Beyond program design, research into successful online learner tactics to overcome obstacles reveals tools students use to succeed online (such as discussion), as well as create high quality capstones. Beisch (2005) studied the relationship between locus of control and academic success in online learner; further, Beisch researched whether successful online learners employed *unique* learning tactics that aided success in an online medium. While a relationship between locus of control and academic success was not found (due to the sample and population studied containing mostly internal locus of control/ high achieving students), the study discovered specific, unique, successful learning tactics of online learners. The two tactics related to successful online discussion were preparation time and interaction with peers via discussion and group work. Concerning preparation, in the interviews, students expressed that online work and discussion “took more time” to prepare and complete than face-to-face coursework; they work ahead of course schedule to ensure successful completion. Further, concerning inter-student interaction in online settings, successful, internal locus students expressed a negative view of group work due to potential negative impact on grades by group members that do not fully participate; further, at best, these high-achieving students expressed a neutral opinion of online discussions; as one student expressed it, “seeking information from peers who may know as much or less about a topic than I did was a waste of time” (p. 83).

### Research Methods Used in the Literature

In the literature, studies employed three primary methods of data collection: discussion post transcripts, participant interviews, and surveys, which were then analyzed in a variety of ways. Penny and Murphy (2009) studied how in many online programs, discussion posts were assessed using rubrics which “highlight differences between a performance that is assessed as fair or poor with a performance assessed as good or excellent” (p. 2). Rubrics articulate specific quantitative and qualitative criteria which students must achieve, and so may encourage students to engage in higher cognitive processes such as when making “new” posts or engagement of others. This study developed criteria and assessed whether a post was “high” or “low” quality based on the degree of engagement of others, as an indicator of cognitive complexity as found by Schrire (2006).

In addition to quantitative analysis, theme and pattern analysis was common method used to generate qualitative data. Attitude surveys and interview responses were used by Bluic, Ellis, Goodyear and Piggott (2011) to gain data concerning student attitudes in online discussion. This data helped shed light onto the correlation between student attitude and cognitive processes displayed in their online discussion posts; high achieving students generally demonstrated positive attitudes towards online discussion while lower achieving students generally demonstrated negative attitudes. Strizich (2010) analyzed interview responses using a color-coding system to mark themes and aligned ideas.

Thus, a review of the literature divulged useful information for conducting a study

on online discussion and academic achievement. There is some evidence that online discussions do indeed assist academic achievement, however, results vary as to what *kind* of online discussion characteristics influence academic achievement. This study assesses a few different characteristics, such as post frequency and quality on academic achievement. Further, the author is curious about how student attitudes towards online discussion may influence discussion behavior as well as possible insights from Dr. Fogg's Behavioral Model on which factors influence online discussion.

As for data gathering and analysis methods in this study, rubrics were used to assess both capstone quality (a modified MSSE capstone rubric) as well as discussion characteristics (frequency and quality). A two-set attitude survey using similarly worded Likert and semantic-differential questions investigated student attitudes towards online discussion; since both sets of questions were modeled after each other, they provided greater validity to the results. A final instrument borrowed from the literature was personal interviews, which provide further qualitative data on factors influencing online discussion behavior, from which patterns or themes may be determined to increase validity of findings.

The literature's findings demonstrate a varied opinion on a common and valued practice of online programs (online discussion) and perceptions of such by high-achieving online students. This highlights a necessity to further investigate the impact (and resulting value for students) of online discussions on academic achievement as well as factors influencing student approaches to online discussion to better describe the relationship, if any, between online discussion and academic achievement. Hence, this

study seeks to build upon the literature, further illuminating whether online discussion is valuable to academic achievement, which factors influence online discussion, if any, and student perceptions of this behavior.

## METHODOLOGY

### Demographics

The sample studied in this project was twenty students enrolled in EDCI 509 from Fall 2015 of the Montana State University Master of Science in Science Education program (MSSE). The MSSE program serves science education professionals in a variety of contexts not limited to classroom teachers, outdoor educators, university faculty as well as governmental program staff. As students are generally working professionals around the globe, the program utilizes several methods to accommodate varied student circumstances. In addition to offering campus-based courses during summer terms, the MSSE program offers a wide range of online courses in science and education.

### Treatment

Twenty graduated students from the Fall 2015 section of MSSE EDCI 509 had their online discussion behaviors and capstones analyzed to determine if there was a relationship between student online discussion behaviors and quality of capstone produced at the end of the program. Over 12 weeks, students completed six assignments which comprise drafts of the sections of their final capstone. Discussion centered around both instructor prompts and peer responses to stimulate reflection on design, overcome challenges, as well as offer support. Each week, each student was required to post at least five times, a requisite two of which structured as responses to a facilitator prompt or

assignment that week. Each individual's weekly posts were analyzed, recorded and then totaled for the semester. Their capstones were also scored according to a modified MSSE capstone rubric. The whole group's discussion data and capstone scores were then analyzed for correlation. Student attitudes towards specific and general online discussions were also surveyed to illuminate whether online discussion behaviors were related to quality of capstone production. Further, factors influencing student online behavior, such as motivations for or obstacles to completing online discussion were investigated via interviews with five participants.

### Instruments

The instruments used in this study are described below. The data triangulation matrix and the timeframe of their utilization are displayed in Tables 1 and 2.

#### Online Discussion Analysis

The online discussion activities of twenty students whose capstones were selected for review were analyzed to extract discrete data of the online behaviors investigated in this study (Appendix A). The number of posts made by each individual student were quantified and recorded in an Excel file containing their survey responses as well as capstone category and overall scores. Further, the quality of posts were scored, recorded, and analyzed based on the complexity of analysis or inquiry demonstrated and/or potential for responses by others as an indication for stimulation of classroom discussion.

#### Capstone Rubric

The capstone rubric, which is a modified version of the MSSE assessment tool, was utilized to quantify and define the quality of capstone produced by an individual

MSSE student (Appendix B). The rubric assesses seven specific categories – Project Design, Data Collection, Pedagogical Techniques, Conclusions, Literature Review, Paper Organization, and Writing Mechanics – as well as yields an overall composite score, which is a sum of the categorical scores. Each category could receive a maximum score of 4 points, for a total possible score of 28 points. It is advantageous to use this rubric since it minimizes the possible bias of retroactively introducing new assessment standards to completed capstones as well as was vetted by all MSSE science and education faculty. The specific category and overall capstone scores were recorded in an Excel sheet along with each individual’s online discussion values and attitude survey data.

### Attitude Surveys

The attitude survey contains two sets of questions that were worded similarly to corroborate their findings (Appendix C). The first set of questions is semantic-differential questions and the second set Likert-style questions. Individuals’ responses were converted into quantified scores and recorded in an Excel sheet next to their transcript analysis scores for thread initiations, replying and reading of others’ posts. The survey also incorporated open-ended questions asking the individual to describe why they responded as they did, yielding qualitative data that may offer further insights as to the motivations for their responses. The survey was a Google Form and disseminated via email to all participants; responses were automatically recorded into a Google Sheet as part of the Google Form software.

### Interview

A recent developing field of technology and psychology called “behavior design” looks at three aspects of human behavior – motivation (benefits), ability (cost/ obstacles to completion), and trigger (prompt). This interview gathered qualitative data on student’s experience of these three factors in relation to their online discussion behaviors. Of the twenty participants, four volunteered for extensive interviews via Skype. All interviews were audio recorded and analyzed along common themes and ideas post-interview (Appendix D).

### Instrument Triangulation and Implementation

Table 1  
*Data Triangulation Matrix*

Focus Question	Transcripts	Capstone	Attitude Survey	Interview
<i>Primary Question:</i> 1. What is the impact of online discussion on capstone quality?	X	X	X	X
<i>Sub-questions:</i> 2. How does the type of post (thread initiation/ reply) correlate to capstone quality?	X	X		
3. How does post quality correlate to capstone quality?	X	X		
4. How are student attitudes towards online discussion correlated to academic achievement?		X	X	X
5. What are some factors impacting online discussion behavior?		X	X	X

Table 2  
*Timeline of Instrument Implementation*

	Early Fall 2016	Late Fall 2016
Capstone Assessment	X	
Attitude Surveys		X
Interviews		X
Transcript Analysis	X	

The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained. See Appendix D for IRB exemption.

## DATA AND ANALYSIS

### Discussion Behavior

As per the requirements of the Fall 2015 EDCI 509 course, students were to produce a minimum of five posts per week for 12 weeks, resulting in a minimum requirement of 60 posts per individual over the term. Capstones were assessed in seven categories worth 4 points each, resulting in a possible total score of 28 points. As described by Table 3 and Figure 1 below, this EDCI 509 group was comprised of high performing students who produced a large volume of posts as well as solid to excellent capstones ( $N = 20$ ). All students, save two, posted above the course requirements; Students 9 and 18 posted just below the minimum requirement producing 58/60 and 53/60 posts respectively.

Table 3  
*Overall Semester Discussion Post Totals Per Student*

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
Total Posts	94	103	144	82	78	81	79	78	58	139	114	170	167	70	191	214	147	53	81	149

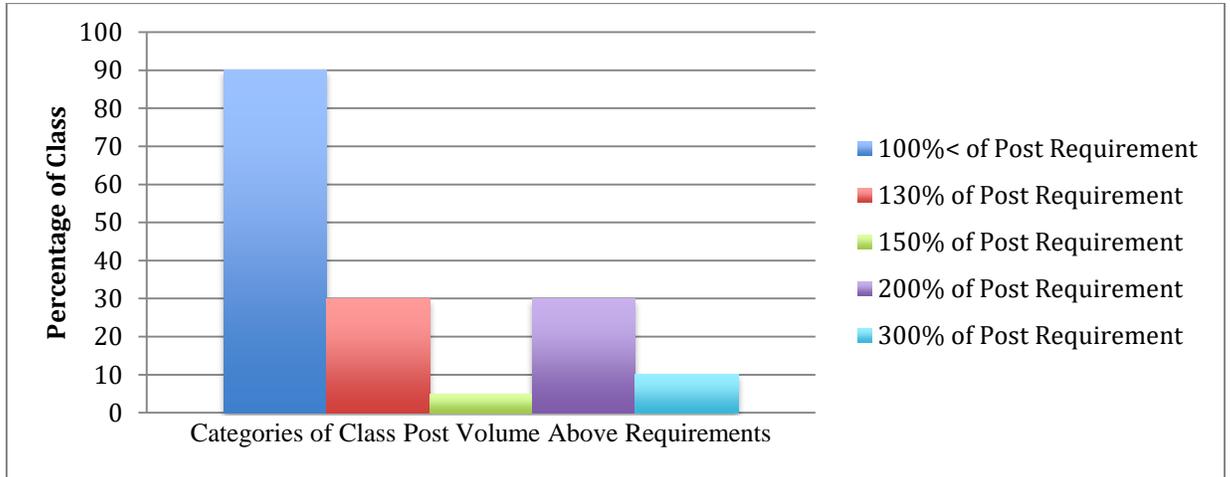


Figure 1. Posting behavior relative to requirement, (N=20).

Generally, student online discussion behavior was quite active, reaching far above and beyond the course requirements. While 90% of students met the course post requirements, 30% of the class posted more than a third above the course requirement and another 30% produced double the post requirement. Further, another 10% of the class posted three times the semester requirement.

Descriptive Statistics of Discussion Post Totals

Overall, the group’s online discussion activity was skewed upwards (Figure 2). The median (98.5) is approximately 1.5 times the semester requirement of 60, while the mean (114.6) is skewed upwards due to a few extremely productive students. The upper quartile spread (49 posts) is more than double the lower quartile spread (19.75 posts), indicating that while students in the lower quartile still posted above requirements, they

performed more similarly, as compared to the upper quartile of students, some of which who were extremely prolific. To that end, the range of the entire group's posting behavior was quite wide, with the maximum poster (214) producing quadruple the number of posts of the minimum poster (53). When considering the central 50%, the inter-quartile range (68.75) is quite pronounced, more than the required amount of posts for the entire term.

*Descriptive Statistics of Group Post Totals*

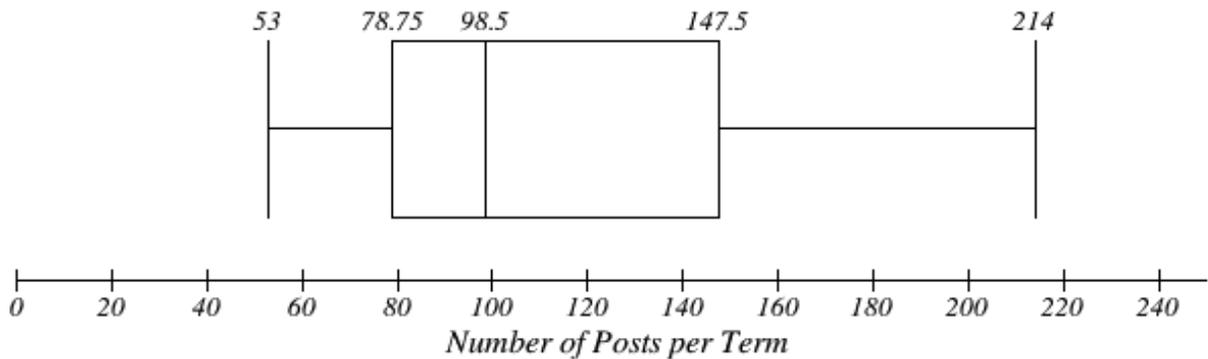


Figure 2. Box and whisker plot of group post totals, ( $N=20$ ).

Descriptive Statistics of Types of Discussion Posts

Various studies in the literature evaluated types of posts, such as thread initiations versus replies, and trends therein. It should be noted, that in the MSSE program, there is some structuring of how threads get initiated. Each week, an individual student is selected to open approximately three threads at the outset of each week to lay a ready foundation for peer response. Other thread initiations by other students are welcomed, but the primary responsibility lies with the “weekly facilitator.” When viewing only the thread initiations of the group, a more consistent perspective of individual posting behavior emerges (Figure 3). The median (33) and mean (33.35, not shown) are closely

aligned and the inter-quartile range quite compact (34), likely due to the course structure. Further, the upper quartile of students did not initiate threads much beyond the median or mean amounts (difference of 2.75 threads), while the lower quartile of students' thread initiations were slightly more varied (difference of five threads). The maximum number of thread initiations (52) was slightly beyond twice the minimum thread initiations (18). When averaged over the term of 12 weeks, the middle 50% of students initiated around 2 – 3 conversations (2.3 and 2.9) per week.

*Descriptive Statistics of Group Thread Initiation Totals*

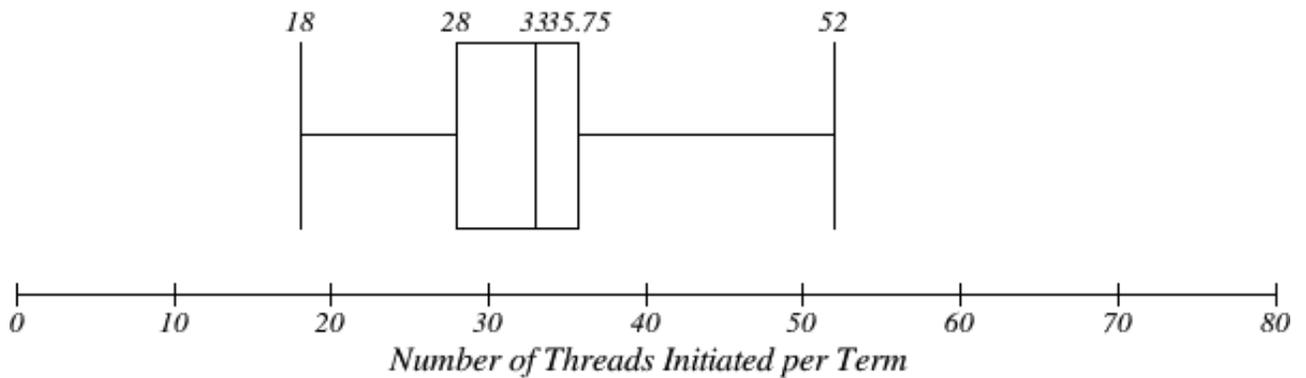
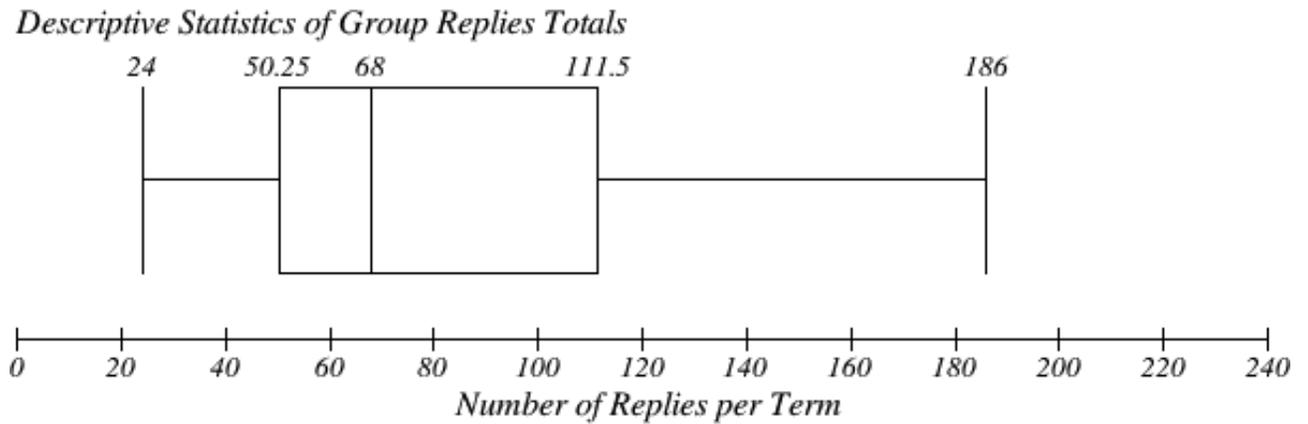


Figure 3. Box and whisker plot of group thread initiations, ( $N=20$ ).

Similar to the overall discussion post descriptive statistics, the descriptive statistics of the group's replies are skewed upwards. The median (68) and mean (81.25) are somewhat divorced, the mean no doubt influenced by the upper quartile (111.5), as well as the maximum (186), indicating that the upper 25% of students replied circa 6 – 9 times a week. Again, the lower quartile of students performed more similarly, with a narrower lower quartile range of only 17.75 replies, or circa 4 – 5 replies a week. The upper quartile is just above double the amount of the lower quartile, revealing a wide inter-quartile range of 61.25, circa 5 replies per week. An even more pronounced production difference is seen between the somewhat reticent, lowest producing student

(24 replies) and most prolific replier (186 replies), with the latter replying nearly 8 times more than the former.



*Figure 4.* Box and whisker plot of group replies to others, ( $N=20$ ).

When comparing the overall post and replies data in Figure 5, it becomes apparent that the majority of discussion behaviors made by individuals were replies, which aligns with the course structure of individual weekly facilitators largely being responsible for thread initiations. For two-thirds of the group, replies comprised circa 70% or more of their total discussion posts. For another quarter of the group, replies comprised circa 50-60% of their total discussion posts.

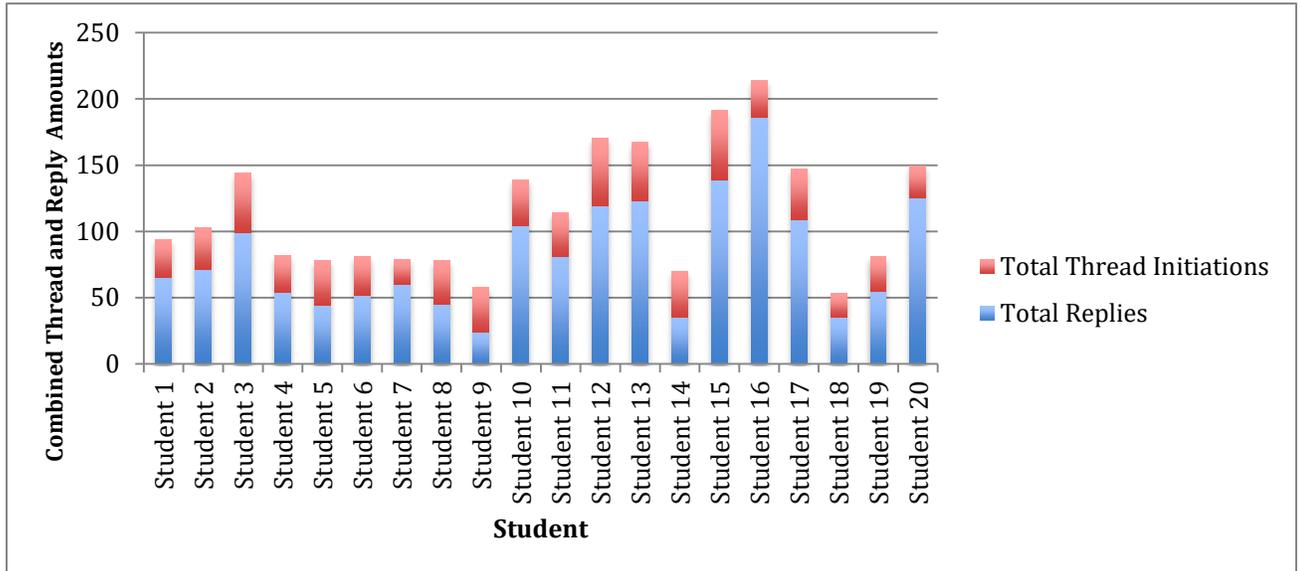


Figure 5. Comparison of overall posts and replies, ( $N=20$ ).

Both statistical sets reflect similar characteristics: a compact lower quartile range coupled with a wider upper quartile range and a maximum that is beyond two times the median and more than four times the minimum (Figure 6). In both statistical sets, the upper quartile is more than twice the number of threads/ replies than the lower quartile. Again, while both quartiles are producing well above the minimum requirement of 60 posts a term, half of the students are posting significantly more in the course. This indicates there is a wide range of online discussion habits among peers. Most students engage in online discussion actively, with many of them interacting with others with extreme vigor.

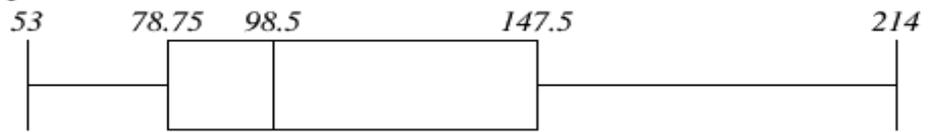
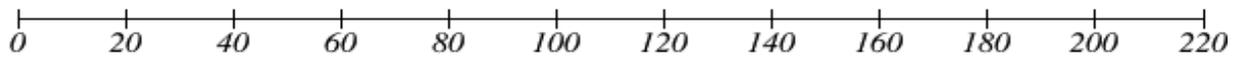
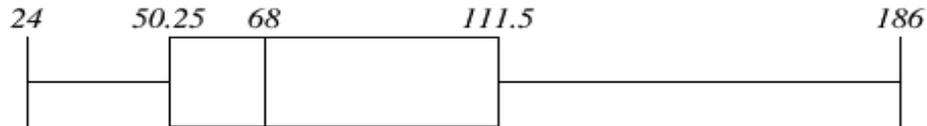
*Discussion Descriptive Statistics**Reply Descriptive Statistics**Comparison of Overall Post and Reply Statistics*

Figure 6. Comparison of overall post and replies descriptive statistics, (N=20).

Post Quality

As in the literature, this study also analyzed the quality posts via the rubric found in Appendix A, described in terms of “high quality” (HQ) or “low quality” (LQ). HQ posts displayed statements of greater analytical investment by the poster and/or invited greater engagement by others in the form of well-crafted questions. LQ posts were primarily described as either short, socially polite responses such as “Thanks!” or “That’s a great idea!”, personally centered statements that did not engender further response from others – “I did (blank) and it seemed to work well,” or were not centered on the conversation topic.

Half of the participants displayed “balanced” discussion behavior with their total posts somewhat evenly split between HQ posts (circa 45% - 55%) and LQ posts (55% - 45%). Of the remaining half of participants, nine displayed HQ posts ranging between 62 – 93%. Only one student displayed a somewhat higher LQ post percentage of 66% of their total posts. Focusing on the nine higher-quality posters, they were evenly spread

with two students posting high quality responses 62% and 63% of the time, 4 students 72%, 72%, 73%, and 77%, one student 81%, and one student 93% of the time.

Correlation between Post Quality and Post Quantity

Concerning correlation between post quality and post quantity, the results were somewhat intuitive. When one compares each individual’s total volumes of posts and the percentages of which were high quality, the below correlation is revealed:  $r = -0.46$  moderate negative correlation. This implies that as the volume of an individual’s posts increases, the likelihood posts are high quality, decreases. It seems to be an additional iteration of the adage: quality over quantity.

Capstone Scores

As displayed in Table 7 and Figure 7, again, this group displayed strong academic achievement, which it should be noted, is a goal of the MSSE program whose education course sequence is designed to strongly nurture quality capstone production by the bulk of its graduates. 80% of this cohort (16 students) earned an 80% or higher. Within that 80%, 25% of students (5) earned between 80-89% on their capstone, 25% earned between 90-99%, and 30% (6 students) scored 100%. Three students scored between 70-80% and only one student had a failing score of 36%. This indicates that similar to their online discussion production, overall, the group performed very well, generally producing strong to excellent capstones.

Table 4  
*Group Capstone Composite Scores (28 Possible Points)*

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
Capstone Score	28	25	27	23	26	28	25	27	10	25	21	28	28	28	21	21	27	23	28	27

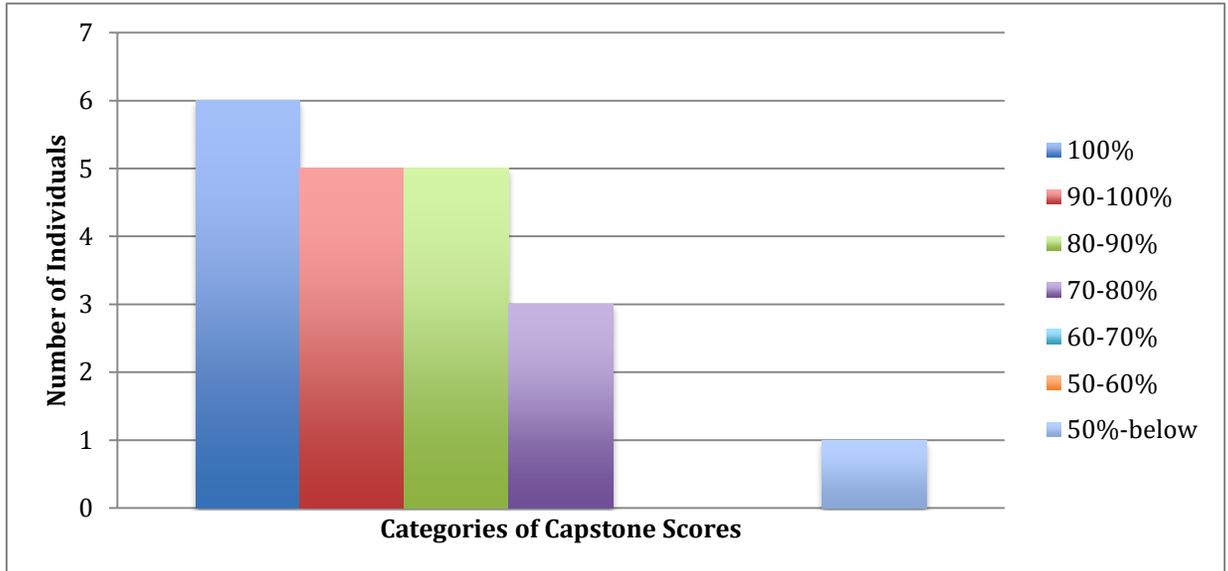


Figure 7. Distribution of group capstone percentage scores, ( $N=20$ ).

Figure 8 displays a robust group trend of capstone performance. The upper quartile and maximum are both 28 out of a possible 28 points, with a close median of 26.5/ 28 points. The mean is skewed downwards due to a significantly low minimum of 10/ 28 points by the failing student. While the lower quartile range (3.5 points) is twice that of the upper quartile range (1.5 points), the inter-quartile range is a narrow 5 points, indicating that central 50%'s capstones scores were consistently within the A – B range, varying at the most, by 20%.

*Descriptive Statistics of Group Capstone Composite Scores*

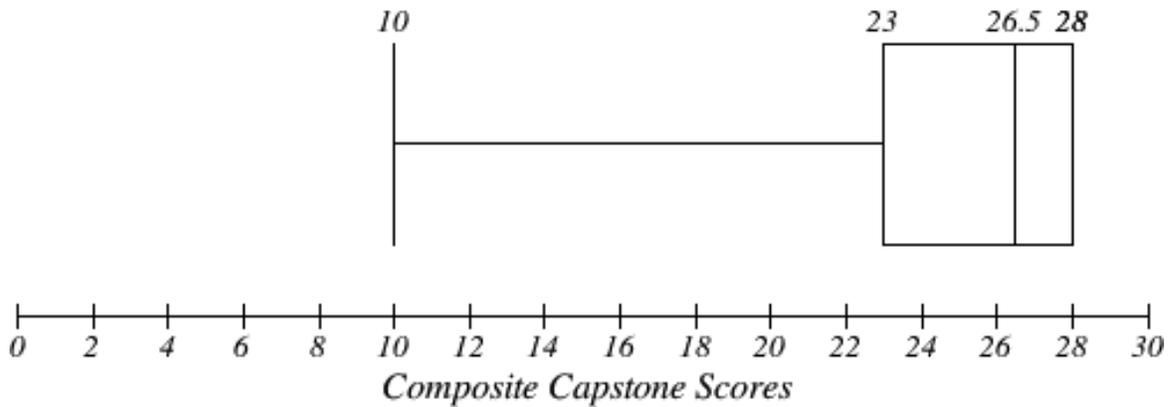


Figure 8. Box and whisker plot of capstone scores, ( $N=20$ ).

Analysis of Extremities in Online Discussion and Capstone Scores

Since most students produced both strong capstones and online discussion, it is worth focusing on the atypical students who displayed divorced academic behavior of either a strong capstone or strong online discussion behavior. Working backwards from capstone production, four individuals received circa 75% or lower on their capstones. Three of the students who scored circa 75% on their capstone were some of the most prolific online posters in the class. Student 11 posted nearly double the course requirement, nearly 5% of the total class posts, Student 15 posted triple the course requirement, nearly 8% of total class posts and Student 16 posted 3.5 times the course requirement, also nearly 10% of the total class posts for the term. Of the lower quality capstone producing students, only Student 9 displayed somewhat aligned academic behavior of a failing capstone and posting just under the minimum of the course requirement.

From the opposite perspective, focusing on the upper range of discussion posters and trends in their capstone quality production, a more varied perspective emerges. The

range of capstone scores from the upper quartile of online posters range from 75% to 100%. Having just discussed the three C-grade capstone students, removing them from consideration of the upper quartile of online posters leaves a capstone score range of between 89 – 100%. The scores are somewhat evenly distributed with two students receiving an 89% on their capstone, three students receiving a 96%, and the final two students scoring 100% on their capstone. Within these capstone score sub-groups, the two students who scored 89% on their capstone had somewhat differing post amounts (103 versus 139 total) with one posting nearly a third more than the other, circa 9 vs. 13 posts per week on average. Of the three upper quartile discussion posters who scored a 96% on their capstone, all three posted similar amounts of around 2.4 times the course requirement, or circa 12 posts a week. Of the two students in the upper quartile of posters who scored 100%, they also posted similar amounts of nearly 2.8 times the required amount, or circa 14 posts per week, or 7% of the total posts for the class each.

In order to truly investigate if online posting is correlated to academic achievement, it is wise to then consider the students who scored high on their capstones, but were in the lower quartile of online posters. All five students in the lower quartile of posters scored between 96 – 100% on their capstones, four of which scored 100%. Of these five students, four of them posted just above the course requirement of 60, with circa 1.3 times the requirement, or 6 posts per week, while one student posted 1.5 times the requirement, circa 8 posts per week. This is quite a revealing perspective that while all were not prolific online posters like some of their peers, the quality of their capstones was still quite high. The lowest posting student is of particular interest; while they only

posted 53/60 required posts for the year (88%), far below that of their peers, they still scored a moderate 82% on their capstone.

#### Correlation between Discussion and Capstone Score

With this information in mind, the correlation coefficient between overall discussion post amounts and capstone scores (Table 5 and Figure 9) using all participants' data is .09, indicating there is no correlation between student online discussion amount and capstone quality. To investigate whether specific types of discussion behaviors such as high quality posts, thread initiations and replies are correlated to capstone quality, their respective correlation coefficients are presented below:

Correlation coefficient of thread initiations and capstone score: .05 No correlation

Correlation coefficient of replies and capstone score: .09 No correlation

Correlation coefficient of high quality posts and capstone score: .4 Moderate correlation

When considering only the top capstone producers who scored between 96-100%, there is a weak negative correlation (-.3) between capstone score and online post amount. When only considering the bottom 50% of capstone producers who scored between 36-89%, there is a stronger negative correlation of -.6. When removing the extremely low scoring capstone student (36%), there is still a negative correlation of -.5.

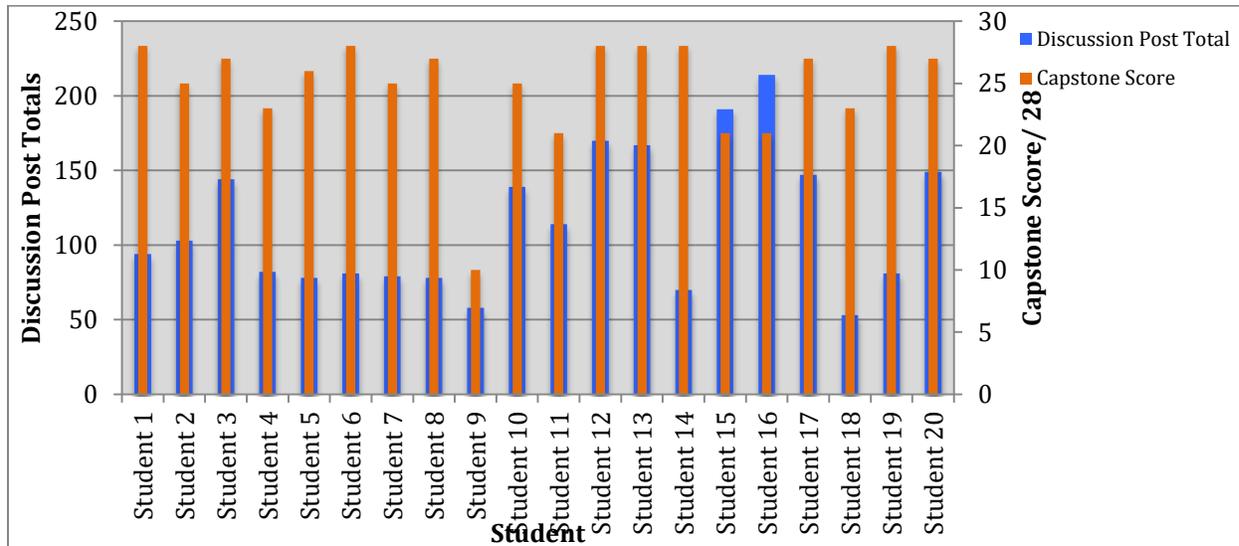


Figure 9. Overall semester discussion post totals and capstone scores per student, ( $N=20$ ).

While post amount or type of post (thread initiation vs. reply) was not found to be correlated to academic achievement, the quality of post was moderately correlated to academic achievement. Half of the class posted similar amounts of HQ and LQ posts (circa 45 – 55% of each). Six of the ten “balanced” posters produced capstones scoring between 89 – 100%, three balanced posters’ capstones scored 75%, and one produced a capstone scoring 36%. Of the HQ posters (displaying an HQ post amount above 60%), all ten had capstones scoring 82% or higher, with seven of those ten producing capstones between 93 - 100%. When one removes the lowest quality poster (36%) from analysis, the correlation coefficient between post quality and academic achievement elevates slightly to .5. Figure 10 shows the comparison of HQ post amount and capstone score, ranked in order of greatest percentage of HQ posting.

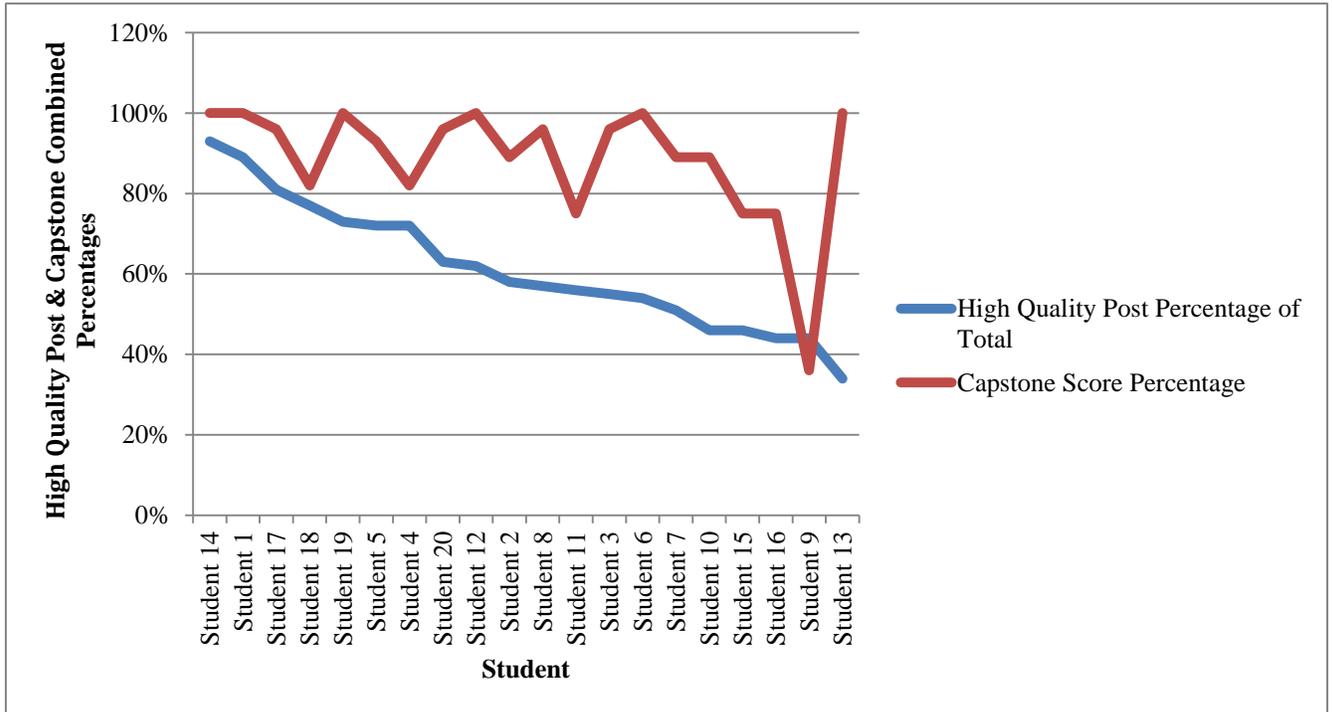


Figure 10. Combined high quality post percentage of total and capstone scores, ( $N=20$ ).

The groups' trends in online discussion behavior and capstone quality indicate that in both cases, the majority of students performed at or above course expectations. The majority students produced solid work on and offline. In online discussion, 90% of students posted well beyond the required amount, with 70% of the class posting double or triple the course requirement. Two individuals produced nearly 20% of the total course posts. In addition, the quality of post by the group was consistently moderate to strong, with half the class posting about the same number of HQ and LQ posts and the remaining half producing consistently HQ posts. Concerning capstone production, again, the majority of the class produced A-grade capstones, while another quarter of students produced B-grade capstones. While no correlation between online discussion amount and

capstone quality was manifested in this group, the quality of post produced by an individual was positively correlated to higher academic achievement.

#### Correlation Attitude and Capstone Quality

Below are survey responses concerning the value and motivation of all participants towards online discussion grouped into question pairs for validity. For example, Questions 1 and 6 are essentially the same question, worded slightly differently so as to increase the validity of the survey's findings based on the consistency of respondents' answers.

Correlation between the perceived importance of online discussion by participants and capstone score:

Question 1:  $r = -0.74$  Strong negative correlation

Question 6:  $r = -0.18$  Mild negative correlation

The above results are interesting from multiple perspectives. First, questions 1 and 6 are essentially the same question and per individual, the responses are fairly consistent between questions 1 and 6, though there is some fluctuation in intensity. All respondents, save one, consistently expressed they felt online discussion was important to academic achievement, with a third of participants denoting they strongly felt so. When comparing the respondent's answers to question one and their capstone scores, there reveals a strong negative correlation. When comparing survey responses to question 6 and capstone scores, though question 6 is a similar to question 1, only a slight negative correlation was revealed. Given the similarities between the questions, one would expect a similar correlation coefficient. What is consistent is that there is a negative correlation

between perceived importance of online discussion and capstone score indicating that students with lower capstone scores found online discussion more valuable than students with high capstone scores; the variation in correlation coefficients is likely due to the small sample size of this study.

Concerning the correlation between perceived helpfulness of online discussion and capstone score:

Question 2:  $r = -0.81$  Strong negative correlation

Question 7:  $r = -0.46$  Moderate negative correlation

Beyond just importance, participants generally felt that online discussion was helpful, though the intensity of the responses to questions 2 and 7 are slightly less intense than questions 1 and 6. Two students strongly agree that online discussion was helpful, four agreed and two ranged from neutral to agree. Again, the data from both questions revealed a negative correlation between the perceived helpfulness of online discussion and capstone score, indicating that the more helpful a student found online discussion, the lower their capstone score. As above, the variation in correlation coefficient may be due to the small study sample size and slight variability in their answers from questions 2 and 7.

Finally, the correlation between motivation to engage in online discussion and capstone score is:

Question 3:  $r = -0.56$  Moderate negative correlation

Question 8:  $r = -0.56$  Moderate negative correlation

Table 6 indicates that students had somewhat more varied attitudes towards their motivation to engage in online discussion. While most consistently indicated they felt it was important and helpful to their online achievement, 3 participants leaned towards neutral to mild agreement and one outright disagreed when indicating how motivated they felt to complete online discussion. The correlation between motivation and capstone score is unintuitive, but consistent with the above findings. There is a moderate negative correlation how motivated a student is to complete online discussion and their capstone score indicating again, that greater motivation to engage in online discussion is correlated to lower capstone scores.

Table 5.  
*Attitude Survey Responses with Capstone Scores*

	1.a. I believe online discussion was unimportant/important to my achievement in online courses.	6.a. Online discussion forums were an important part of my learning in online courses.	2.a. Online discussion was unhelpful/helpful to my achievement in online courses.	7.a. Online discussion helped me learning in online courses.	3.a. I was unmotivated/highly motivated to engage in online discussions.	8.a. I was motivated to complete online discussion each week.	Capstone Score
Individual 1	5	Strongly agree	5	Strongly agree	5	Strongly agree	21 (75%)
Individual 2	4	Agree	4	Agree	3	Neutral	28 (100%)
Individual 3	5	Agree	5	Agree	4	Agree	21 (75%)
Individual 4	4	Strongly agree	4	Agree	5	Strongly agree	27 (96%)
Individual 5	5	Strongly agree	5	Strongly agree	3	Strongly agree	25 (89%)
Individual 6	3	Agree	4	Agree	3	Neutral	27 (96%)
Individual 7	4	Neutral	4	Neutral	3	Agree	25 (89%)
Individual 8	4	Agree	3	Neutral	2	Disagree	28 (100%)

### Attitude Survey and Interview Data

8 of 20 voluntary participants completed surveys, which reveal consistent and interesting findings concerning attitudes toward online discussion and reasons therefore (Table 6). The survey's semantic items were converted into numerical values for cross-comparison with Likert items. The first and sixth questions investigated whether or not participants felt online discussion was relevant to their academic achievement. Both questions garnered a score of 4.2 out of 5, indicating that the group clearly felt online discussion was important to their achievement. When inquiring a bit further as to if they found online discussion *helpful* towards their learning, the marks for questions 2 and 7 strayed a bit scoring 4.3 and 4, respectively. Digging deeper to ascertain about how motivated students were to engage in online discussions, questions 3 and 8 reveal that students again felt somewhat motivated to complete online discussion (scores of 4). Many revealing insights were shared in the open-ended portion. Motivations ranged from more self-directed goals such as completing course requirements to staying informed on relevant material to more communal, socially supportive desires such as "enjoying trying to help others" and wanting to "hear all thoughts." The interviews of four individuals further corroborated these findings. All four interviewees described that they felt online discussion was important *because* of the above-mentioned motivations. One interviewee responded "Bare minimums kept me in, but once you were in a discussion, you want to know more and you see other people doing more, so you don't want to be the one not doing as much beyond as they are." Another interviewee shared, "I wanted that A really badly, but after that, the relationships kept me in. If I felt I could share something, then I

got into it and went beyond [course requirements]. Most of the time, you develop rapport.”

Concerning obstacles students experienced in completing online discussion, there was little friction students felt as questions 4 and 9 only scored an average of 3 and 2.3 respectively. While students didn't express intense obstacles, participants consistently expressed that finding time to complete their online discussion was a consistent, universal challenge. Secondary to time, however, were either the challenge of generating “good” comments that would continue the conversation or, if the conversation was not quality, students perceived it to be a “waste of time” and therefore harder to engage in online discussion. In the interviews, participants revealed even more nuanced descriptions of obstacles they experienced when completing online discussion. “D2L is not mobile friendly; that affected how I responded while traveling nationally and internationally.” “Sometimes it was sticky working through threads when a bunch of people posted; [it was] easy to miss things in an active discussion.” Other obstacles revealed in interviews were platform design features. Two interviewees described a desire for the ability to do keyword searches of all threads within a week or the whole term, whether for personal curiosity or related to their capstone project. Further, two also described a desire for some kind of social media aspect where current and past students could stay in touch, continuing professional development and forged relationships.

Finally, when participants were asked about whether they experienced prompts (triggers) to engage in online discussion, survey question 5 scored an average of 4, while question 10 scored 3.6. The external prompts students described in the open-ended

questions as well interviews were purely: 1. discussion thread prompts opened at the beginning of the week, 2. facilitator encouragements or 3. emails from the professor to encourage further engagement. Some students generated their own prompts for online discussion by tying it to some regularly occurring event, such as between the termination of school and the beginning of afterschool games. Concerning platform design, there was some self-attributed lack of utilization of the “response notification feature” in D2L, where one sees a number quantifying the responses to a subscribed thread. Beyond this feature, “I would encourage a third party prompt system; in the Independent term, you are alone. Anything D2L can do to encourage and maintain community online would be good. D2L could be used as a social media platform.”

Table 6.  
*Summarized Interview and Survey Open-ended Responses*

Themes in Interviewee Responses	Individual	Social	Platform-based
Motivations	<ul style="list-style-type: none"> <li>• Discussion and course grades</li> <li>• Capstone and homework completion</li> <li>• Asking questions</li> <li>• Professional growth</li> <li>• Getting the most out of the program</li> </ul>	<ul style="list-style-type: none"> <li>• Discourse with peers</li> <li>• Identity with the group</li> <li>• Building individual relationships</li> <li>• Be seen putting in an effort by others</li> <li>• Sense of community</li> <li>• Inspiration by others</li> </ul>	<ul style="list-style-type: none"> <li>• Reading all posts in threads to make the “unread” number zero</li> <li>• Number notification upon login for subscribed threads</li> </ul>
Obstacles	<ul style="list-style-type: none"> <li>• Time in the face of other obligations</li> <li>• Internet connectivity when traveling</li> </ul>	<ul style="list-style-type: none"> <li>• Not feeling like one has anything to contribute to discussion</li> <li>• Lack of synchronous, live “chat” function</li> <li>• Isolation from other MSSE students</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of nonverbal expression to indicate active “listening”</li> <li>• Lack of ability to keyword search across threads, groups or term</li> <li>• Tracking and following active threads “rabbit-hole”</li> <li>• Lack of mobile app to enable swift tablet/ phone usage</li> <li>• Familiarity with the platform</li> <li>• Lack of “tagging” function to enable searches/ saving like Evernote</li> <li>• Lack of social media extension to nurture community across and beyond program</li> <li>• Erasure of notifications after clicking once</li> <li>• Bland interface facade</li> </ul>
Triggers	<ul style="list-style-type: none"> <li>• Scheduling discussion times with other regularly occurring events</li> </ul>	<ul style="list-style-type: none"> <li>• Written thread prompts at the opening of each week</li> <li>• Weekly discussion requirements rubric</li> <li>• Instructor emails</li> </ul>	<ul style="list-style-type: none"> <li>• Red icon on email</li> </ul>

### Cost/ Benefit Ratios of Online Discussion Behaviors

When interviewees were asked, “Were there any online discussion behaviors that had a higher cost than benefit to you?” participants did not immediately offer an answer, indicating that no particular online discussion behavior was excessively costly. After reflection, two still indicated that no online discussion requirements were too riddled with obstacles to complete. One student mentioned that they did not participate much in the ungraded discussion of Ed. 575. When further probed, “What were the online discussion

behaviors that were high cost, but still offered enough benefit to complete?” students mentioned that answering open-ended questions, or those that required them to reflect on their own practice were “taxing but entirely worth it. [They were] a tremendous value, and keeping those posts for future reference was totally worth it.” Another student mentioned that,

When we had to dig into the text, the AR texts, after a while I was like ‘why, I don’t want to do this,’ but if you took the time to make a good post or reply, it helped you understand the whole AR process. When creating a more involved post, it helped you more later.

Finally, when asked if there were any online discussion behaviors that they did not feel offered any benefits, interviewees were bicameral. “Redundant posts, overlap in conversation or people just trying to meet their requirements [were too costly.]” “No, coming fresh off on-campus, there is a certain amount of time that should be dedicated to classroom activities.” “I can’t really think of anything offhand. [The instructor] designed it in such a way that there is a reason for everything we do. I trusted him.” Participants were then asked to rank the most influential factors on their online discussion from most influential to least influential. Those rankings are reflected in Table 6, with most influential factors listed first and least influential factors last.

## INTERPRETATION AND CONCLUSION

### Discussion Behavior

Generally, student online discussion posting was prolific with 90% of students meeting or exceeding course requirements (all save two), and nearly half of students posting double or triple the required amount for the course. This trend shows that in general, students engaged readily with each other in online discussion, with some

students producing a significant portion of posts in the course. Similar to classroom discussion, perhaps this indicates that online, while mostly everyone strives to meet classroom requirements, there are also individuals who are more expressive or “extroverted” than others, “speaking” far more than their competent but more reticent peers.

### Influence of Replies on Overall Discussion

When one compares the overall post and reply data, it becomes apparent that replies comprise the majority of online discussion behavior of students, which aligns with the course structure of designated individual facilitators largely being responsible for weekly group thread initiations. Students initiated a similar volume of threads as their peers (IQR 7.75, a difference of less than 1 thread per week), circa 33 threads (median and mean) over the course of the term (circa 3 threads a week). A much wider range of replies per individual was expressed (IQR 61.25, a difference of 5 replies per week) with the median reply amount double that of the thread initiation value (68).

Beyond the course structure of thread initiations, this seems intuitive when one also considers the nature of classroom discussion; typically, a question or challenge is posed and then peers offer several suggestions or insights to the inquisitor in the quest for understanding or achievement. Another consideration is that generating answers is somewhat easier than generating questions. When answering a question, one is focused on the limits set by the question, when creating questions, an individual must analyze a wider range of factors in a given task. The relative ease of replying to others’ questions may also encourage student online discussion behavior to center around replies rather

than thread initiations. As stated by Dr. Fogg's research, "any comment is positive...[and] strengthens that relationship [with another]" (2010). Regardless, the above data indicate that the group's discussion production was generally quite active, with each student at the very least initiating conversation about as much as their peers and supporting each other heartily, reaching out more to interact with others than draw attention towards themselves.

#### Correlation between Post Quality and Post Quantity

As stated above, the correlation between volume of posts and the quality of posts is -0.46 meaning that as the volume of posts increases, the likelihood of it being a high quality post decreases. This is consistent with the above statements and intuition in that low quality comments are easier and quicker to manufacture, do not receive negative feedback and offer some possible social benefit to the poster and recipient by "strengthening that relationship" (Fogg, 2010). Therefore, if an individual may post as much as they please beyond the academic requirement and low quality posts offer no risk, minimal obstacles and possible social benefit to the poster, then making posting more often, even if the posts are low quality, is the behavior with best cost-benefit ratio.

#### Capstone Scores

Just over half of the students received a capstone score between 90-100% (a six scored 100%, five received 90% or higher), while another quarter of students scored between 80-90% on their capstones. Three students scored between 70-80% and only one student had a failing score of 36%. This indicates that similar to their online discussion

production, overall, the group performed very well, generally producing strong to excellent capstones.

There is a trend of individuals scoring quite well on their capstones. The upper quartile and maximum are both 28 out of a possible 28 points, with a close median of 26.5/ 28 points. The mean is skewed downwards due to the significantly low minimum of 10/ 28 points. While the lower quartile range (3.5 points) is twice that of the upper quartile range (1.5 points), the inter-quartile range is a narrow 5 points, indicating that group's capstones scores were within the A – B range, varying at the most, 20%. Overall, the majority of students produced good if not excellent final capstones, which as stated previously, is a goal of the MSSE program.

As in online discussion, the individuals of the group consistently displayed high quality work, with the majority of students (75%) scoring between 80-100% on their capstone, with two-thirds of that scoring between 90-100%. Concerning lower performance in online discussion or capstone production, only two students posted just under the minimum discussion requirements (97% and 88%), three students scored 75% on their capstone, while student one received a failing capstone grade (36%). Outside the failing capstone score, a median score of 95% and mean score of 91%, the class displays a strong trend in online discussion behavior and quality capstone production.

#### Correlation of Discussion and Capstone Quality

Given the above patterns in both online discussion behavior and capstone quality, this project seeks to answer the primary question: what is the impact of online discussion on capstone quality? The correlation coefficient calculated from this group's overall

discussion posts and capstone scores is .09, indicating there is no correlation between student online discussion amount and capstone quality. A few considerations come to mind as to why this may be.

First, given that the significant majority of the class performed at an “A-level” or above in both online discussion as well as capstone quality, this relatively uniform, high performing group left a very small minority upon which to calculate correlation between discussion behaviors and capstone quality. All students save two met the posting requirements, and those two only under-posted by a few percent, in other words, they were still “A” discussion students. Second, while a student could write an unlimited number of posts, resulting in a wider range of online discussion patterns among the class, the capstone score was capped at 100%, not allowing any further expression of mastery beyond the limits of the rubric. In other words, one set of data could continue to express intensity of individuals’ online production *ad infinitum*, while another data set was truncated at 100%, unable to escalate further. This impossibility to express achievement beyond the course requirement within a capstone displays a group trend that is unvaried; most students received an “A,” therefore an upward trend in the online discussion data was impossible to reflect via the capstone rubric, if such a trend existed. The two data sets are inherently divorced as one could continue expressing intensity of achievement, while the other could not.

A third consideration as to why there is no correlation between online discussion amount and capstone quality is that perhaps the students of this study were generally all very competent and able to grasp the course material, meeting the course requirements of

both online discussion and quality capstone production to the degree of their satisfaction. Some students chose to post prolifically and also produced quality capstones, while other students chose to not post nearly as much, while still producing solid capstone projects. As in classroom discussion, lack of voluminous response is not inherently an expression of lack of understanding or interest; rather, conversational behavior trends are more an indication of personality.

While general online discussion is not correlated to capstone quality, this study further investigated how the type of post (thread initiation/ reply) correlates to capstone quality. Again, as with general online discussion, the correlation coefficient between thread initiations and capstone scores is .05, indicating no correlation. Further, the correlation coefficient between replies and capstone score is .09, also indicating there is no correlation. Given that replies are the majority of online discussion and there is no correlation between general online discussion and capstone quality, it comes as no surprise that replies are also uncorrelated to capstone quality. The group's trends in thread initiations were more uniform with everyone initiating about the same number of threads, likely due to course structuring of thread initiations, and since everyone also scored relatively similarly on their capstone, there is little variance in the data, resulting in no correlation to detect.

A final consideration concerning the lack of correlation between general online discussion amount and capstone quality is the degree of difficulty between posting online versus writing a capstone. This is corroborated by the qualitative data collected in the interview and open-ended survey questions and the HQ/ LQ posting trends of the group.

Writing a low-quality post, whether it be a thread initiation or reply to another, is generally a relatively easy task, involving a few minutes for thought and execution. HQ posts took a bit more effort in order to read texts and others' posts in order to formulate stimulating responses to perpetuate conversation. As expressed in the data, it seems that everyone, including the lowest performing students, were more than capable of consistently "showing mastery" in online discussion. Further, online posts are self-contained demonstrations of academic effort; errors or successes of one post do not influence other posts generally. Contrast this with the complexity of planning, researching and executing a good capstone study where any flaw in a previous part of the process can compound into significant issues in the final product. Further, the focus and effort required to write a capstone are significant compared to the relative ease with which one writes an online post. An online post requires less effort and poses less risk than producing a quality capstone. It is a more accessible behavior; therefore, both low and high performing capstone students may execute online discussion well, uncorrelated to their capstone production.

While neither the total amount of discussion posts nor the post type is correlated to capstone quality, post quality was moderately correlated to capstone quality ( $r = .4$ ). The qualitative findings illuminate why this may be. When discussing behaviors that were "high cost, but also high benefit," students described the rigor and multi-faceted motivations required to generate a good thread initiation or reply. Reading through dense texts, reflecting on one's practice, and designing questions that would perpetuate healthy conversations coupled with a desire to gain and offer valuable knowledge were all factors

in creating HQ posts. In other words, creating worthwhile posts involved overcoming more obstacles than generating LQ posts. It is reasonable to infer that those students who more frequently overcame those HQ post obstacles were also more likely to be those who overcame the complex obstacles of capstone production. Especially given that discussion topics were centered around nurturing students through specific aspects of their capstone, those who engaged in more frequent “rehearsal” of high quality skills via online discussion, may have been more prepared for, or experienced fewer obstacles producing their final capstone than students who posted LQ more frequently.

#### Attitudes Towards Online Discussion and Academic Achievement

From students’ perspectives, student attitudes were generally positive towards online discussion. Both sets of attitude survey questions corroborate each other’s findings in that students generally felt that online discussion was both important and helpful to their academic achievement. However, there were consistent negative correlations of varying degrees (possibly due to the study’s small sample size) between the perceived importance (-.74, -.17) and helpfulness (-.81, -.46) and academic achievement, as well as motivation to complete online discussion (-.56). These correlations imply that the higher an individual’s positive valuation of either importance or helpfulness of online discussion, the lower their capstone score. One reason for these negative correlations may be that weaker students, or those who struggled more with capstone challenges, received more benefit or support from online discussion than stronger students in overcoming these challenges. This is in agreement with the literature (Beisch, 2005) that higher achieving students find online discussion not as beneficial an investment of their time. At

best, these high-achieving students expressed a neutral opinion of online discussions; as one student expressed it, ‘seeking information from peers who may know as much or less about a topic than I did was a waste of time.’” (p. 83). Further, this perhaps partially supports the somewhat strong negative correlation between motivation to complete online discussion and academic achievement (-.56). This is somewhat unexpected given that while student attitude responses imply students found online discussion important and helpful, their responses were more varied concerning how motivated they felt to complete online discussion. This implies that something external to internal motivation may be posing an obstacle(s) to students completing online discussion.

#### Factors Affecting Online Discussion

Further, students were motivated by a variety of factors to engage online, for reasons including garnering help for their own academic success on homework or the capstone, as well as supporting each other and nurturing their community that had been created over the years in the MSSE program.

While on average students felt unencumbered while completing online discussion, successfully finding solutions for personal challenges such as time and Internet connectivity, the category with the greatest variety and volume described by participants was *platform-based obstacles*. The author would like to note that the intensity of social media utilization by the general population may be changing current and future students’ expectations of online platforms.

The list of platform-based obstacles can be concentrated down into further sub-categories: engagement, function, and fluency. Concerning engagement on the D2L

platform, surveys and interviews expressed a desire for some way to indicate “active listening” or attention such as what is expressed via “likes” or emoticons on Facebook, an update of its façade to be more “bright or colorful” and integration of community-creating features such as Facebook groups. Concerning function, the ability to do “Google-like searches” within D2L course threads was repeatedly mentioned as highly desirable. Students wished to make full utilization of not only the week’s information, but also concentrating that of prior weeks, other sub-groups within a class, or that of previous courses. Currently, students must click through several links and webpages to access a specific comment, perhaps slowed down significantly by glacial Internet speeds, only for the result to be embedded in a limited view of only the most adjacent, chronological posts. While synchronous conversation is beholden by time, participants and the author recognize that in the sacrifice of dynamic conversation by asynchronous discussion, it offers a boon of timeless knowledge if able to be concentrated and displayed effectively for the user. By extension, allowing topical searches via “tagging,” such as on Twitter™, or a “clip and save” function such as in Evernote were also mentioned as platform enhancing features by participants. Finally, the lack of mobile capacity of the D2L platform was a significant obstacle to online discussion. A mobile app would not only draw less data than a full website (which is prohibitively costly or impossible in certain regions), but also allow for phones, tablets and other travel-common devices to more easily and swiftly connect, allowing for more frequent login and commenting by students. Concerning fluency, one interviewee mentioned that “while non-tech savvy, older students [who use social media] might not know what they are missing, younger

incoming students are more fluent and will want more collaborative things [in the platform], like Facebook.”

The prompts students experienced were purely manual functions - discussion post threads opened at the beginning of the week, facilitator encouragements or emails from the professor. While these are functional prompts, they are all person-to-person and as such, are relatively labor-intensive for the prompter. As for automated prompts, some participants described that they did not use the notification or subscription functions early in their program due to being “lazy” or not knowing it was available on D2L. The author wonders if having to “subscribe” to a thread is too much of an obstacle for some users. Facebook’s notification system is reversed, where one is automatically subscribed to any conversation one comments on and must overcome the (minor) obstacle of manually unsubscribing to cease notification. This would likely result in more frequent notifications to students, perhaps prompting greater volumes of students logging in. As Dr. Fogg said “without commenting everything would fall apart” and the consistent, quiet reinforcement of commenting behavior is numerical notification icons.

As a topic of great importance in the young, digital education age, this project further offers insights into whether online discussion is directly correlated, and therefore possibly critically important to academic achievement in online courses. While only post quality was correlated to academic achievement, the investigation into online discussion and academic achievement furthered intense reflection and inquiry into the intersection of student motivations, obstacles and technological design, revealing coiling, numerous branches into future study and achievement in online education.

Articulating a few potential future academic trails laid open by this study, the prospects are enticing, the first of which would be to run a similar study as this one, but on a much larger population of MSSE students within the same course and professor over many years. The robustness of a larger data set would give greater clarity to the minutiae of potential correlations. Further, since the qualitative data implies that academically weaker students may perceive greater academic value from online discussion than higher achieving students, a larger study with more varied academic achievement data may reveal more articulate perspectives.

Concerning quantitative aspects such as online discussion structure and capstone assessment in this study, this study's thread initiations were structured as part of the course and potentially as a result were not able to display correlation to academic achievement. A future study with different discussion structure may inquire as to if thread initiations are indeed associated with academic achievement. Further, as stated earlier, the measurement of post volume by individuals could describe unlimited intensity while capstone quality quantification was limited by the rubric. A study with a different academic achievement measurement that could show continuous, linear achievement akin to individual's posting behavior may reveal interesting insights.

The qualitative data offers many potential intriguing journeys as well. Quality, not quantity, of posts was found to be associated with academic achievement, therefore investigation into online discussion assessment and structures which rely on quality as the primary assessment versus weekly quotas may reveal more insight and guidance on how to further encourage lively discussion and academic achievement in online courses. Also,

while most students consistently indicated that they felt online discussion was important and helpful, many indicated tepid motivation to complete it. To that end, students indicated in their interviews and surveys that factors such as finding the time to complete online discussion as well as ensuring they were constructing a quality post (lest it be a waste of time) were concerns impeding their motivation to complete online discussion. The students' responses imply that they have motivation to produce quality posts but feel time and self-assurance of quality are obstacles. As stated above, a behavior manifests at the intersection of motivation, reduced obstacles and a trigger. Since post quality is associated with academic achievement, and as indicated above, students are motivated to produce quality posts, then further, more intensive study into internal and external obstacles experienced by students as well as their reduction, in addition to effective discussion triggers made for or by students, could prove fruitful and potentially revolutionize online discussion.

To delve specifically into investigation of obstacles and their amelioration, this study revealed some valuable insights into LMS platform-level obstacles experienced by students. LMS adaptations and modifications recommended in this study include more notification prompts and “active listening” responses akin to “Facebook likes”, emoticons or upvotes. Or, the ability to do more intensive information mining via keyword searches across threads, time and perhaps multiple cohorts or courses as well as the ability to commenting and “tag” items potentially allowing online discussion to become a form of compound annotated discourse not unlike that of religious study creating a flowering, written conversation carried through time and geography. A mobile app would ease

device and network accessibility obstacles. In line with market analytics, study into LMS façade aesthetics and formatting may also reveal new opportunities in creating motivation in students, begetting more active online discussion and academic achievement.

#### VALUE

While this study revealed some correlation between online discussion and academic achievement, it more importantly revealed valuable insight into factors affecting student online behavior, which is applicable to future online discussion and LMS design. From the perspective of behavioral design, if a behavior manifests in the intersection of motivation, ability and a prompt, then the consistently high academic achievement of this study's participants is a strong indicator of already thriving student academic motivation. Rather than focusing on "amping up motivation," in the work of Stanford and Dr. Fogg, the qualitative treasure-trove of insights in this study, as well as in the experience of the author as a student and educator, it is the work of educators and online facilitators to first focus on reducing the obstacles faced by online students, nurture in them tiny habits which blossom into abilities allowing for surmounting of greater, future challenges, and then developing subtle, but effective prompts to assist students in realizing their internal motivations, inherently laying clear paths to success.

Looking outwards towards successful technological behavior facilitators already realized in social media platforms such as Facebook, Twitter, and Reddit, there is much that can be borrowed and permutated for education in order to facilitate behavior outcomes and change, or as the author envisions, *eudaimonia* (human flourishing) in students. As with students' motivations, online platforms blur the boundary between

serving pure social or educational purposes. A core motivation for learning of the individual is alignment of self-image with self-ideal, which in many ways has fewer obstacles to its accomplishment via online platforms. The past ten years of online development expresses social media's powerful ability to harness human tendencies to seek out relationships with others and nurture those relationships, as described in Maslow's Hierarchy of Needs: the need to *belong*. The individual needs to be relevant and approved of by others, even if by way of digitally manifesting self-image closely aligned with self-ideal through the giving and receiving of comments, upvotes, and inclusion into others' self-curated narratives expressed on a "wall." Anecdotally, as based on the instructional and student experiences of the author as an impassioned music director and science instructor, as well as that of my peers, the awareness of one's identity and value to the group, in other words, social value in a face-to-face or online class, is a key feature of learning regardless of content or environment. For this educator, this study has only served to lay wide and long the vision of more explorations into designing personal and professional flourishing.

REFERENCES CITED

- Beisch, M.A. (2005). Learning Tactics of Successful Online Learners. (Doctoral Thesis). Retrieved from <http://scholarworks.montana.edu/xmlui/bitstream/1/920/1/BesichM0505.pdf>
- Bliuc, A.M., Ellis, R.A., Goodyear, P., & Piggott, L. (2011). A blended learning approach to teaching foreign policy - Student experiences of learning through face-to-face and online discussion and their relationship to academic performance. *Computers and Education*, 56(2011), 856-864.
- Chen, R. T. H., Bennett, S., & Maton, K. (2008). The Adaptation of Chinese International Students to Online Flexible Learning: Two Case Studies. *Distance Education*, 29(3), 307-323.
- Cheng, Lily. (2010, August 10). How Facebook Influences You (hot triggers!). Retrieved from <http://captology.stanford.edu/resources/video-how-facebook-influences-you-hot-triggers.html>
- Drennan, J., Kennedy, J., & Pisarski, A. (2005). Factors Affecting Student Attitudes Toward Flexible Online Learning in Management Education. *The Journal of Education Research*, 98(6), 331-338.
- Fogg, B.J. (2008, December 19). The Power of Comments on Facebook. Retrieved from <http://captology.stanford.edu/resources/video-the-power-of-comments-on-facebook.html>
- Fogg, B.J. (2017). *Behavior Design*. Retrieved from <http://captology.stanford.edu/projects/behaviordesign.html>
- Palmer, S., Holt, D., & Bray, S. (2008). Does the discussion help? The impact of a formally assessed online discussion on final student results. *British Journal of Educational Technology*, 39(5), 847-858.
- Pena-Shaff, J., Altman, W., & Stephenson, H. (2005). Asynchronous Online Discussion as a Tool for Learning: Students' Attitudes, Expectations and Perceptions. *Journal of Interactive Learning Research*, 16(4), 409-430.
- Penny, L., & Murphy, E. (2009). Rubrics for Designing and Evaluating Online Asynchronous Discussions. *British Journal Of Educational Technology*, 40(5), 804-820.
- Ramos, C. (2008). Hits (not "Discussion Posts") predict student success in online courses: A double cross-validation study. *Computers and Education*, 50(4), 1174-1182.

- Schrire, S. (2006). Knowledge building in asynchronous discussion groups: Going beyond quantitative analysis. *Computers & Education, 46*(1), 49-70.
- Strizich, L. J. (2010). *Assessment of distance education programs in the Montana University System*. (Doctoral Thesis). Retrieved from <http://scholarworks.montana.edu/xmlui/bitstream/1/2363/1/StrizichL1210.pdf>
- Summers, J.J., Waigandt, A., & Whittaker, T., (2005). A Comparison of Student Achievement and Satisfaction in an Online Versus a Traditional Face-to-Face Statistics Class. *Innovative Higher Education, 29*(3), 233-250.
- Thomas, M.T.W. (2002). Learning within incoherent structures: the space of online discussion forums. *Journal of Computer Assisted Learning, 18*, 351-366.

APPENDICES

APPENDIX A  
DISCUSSION POST QUALITY RUBRIC

	High Quality	Good Quality	Low Quality	Poor Quality
DISCUSSION POST QUALITY CRITERIA	Demonstrates sophisticated analysis of topic; poses an in depth question with clear focus to the group; allows for extensive responses by others	Poses an open question to the group; offers a clear, thought out statement to another; reflects some analysis of the topic	A direct response but doesn't engender further responses by others; minimal analysis of the topic; poses a question not on topic	A response not related to the topic

APPENDIX B  
CAPSTONE RUBRIC

<b>CATEGORY</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>Category Score</b>
<b>Project Research Design</b>	A logical research design of the project was evident. No one would question the design.	The research design was solid, but 1 or 2 minor points were overlooked.	The research design of the project was minimal, several minor and/or major errors were evident.	The research design was seriously flawed.	
<b>Data Collection Techniques</b>	The data collection strategies clearly provided information that answered the focus question.	The data collection strategies provided information that answered the focus question, but 1 or 2 strategies were omitted.	The data collection strategies clearly did not provide enough information that answered the focus question.	Data collection strategies were poorly designed.	
<b>Pedagogical Context</b>	The pedagogical context was extremely well explained. The science/math content was included in a logical form (outline, etc.)	The pedagogical context was explained, but needed expansion for reader comprehension. The science/math content may or may not have been included in a logical form (outline, etc.)	The pedagogical context was not explained. The science/math content may or may not have been included in a logical form (outline, etc.)	The pedagogical context was not included and/or the science/math content was not included.	
<b>Conclusions</b>	Logical, solid conclusions were drawn based completely on the data.	Logical, solid conclusions were drawn based completely on the data, but some conjecture and/or errors were included.	The conclusions drawn contained errors.	No conclusions were drawn.	
<b>Literature Review</b>	The conceptual framework clearly related to the focus question. A thorough review of the literature was presented.	The conceptual framework related to the focus question, but 1 or 2 pieces of evidence were omitted from the review of the literature.	The conceptual framework loosely related to the focus question. A thorough review of the literature was not presented.	Information had little or nothing to do with the main topic.	
<b>Paper Organization</b>	The flow of the paper was logical. Sections were well organized. Important elements were included.	The flow of the paper logical, but needed revision.	The flow of the paper needed major revision, even after several rewrites.	The flow of the paper was extremely difficult to follow.	
<b>Mechanics</b>	Virtually no grammatical, spelling or punctuation errors. All formatting was done correctly. Minimal revision was necessary.	Almost no grammatical, spelling or punctuation errors. All formatting was nearly correct. Minor revision was necessary.	A few grammatical spelling, or punctuation errors. A few formatting errors existed. Revision was necessary.	Many grammatical, spelling, or punctuation errors. Formatting errors abounded. Major revision was necessary.	
<b>Overall Capstone Score</b>					

APPENDIX C  
ATTITUDE SURVEY

Section One

**Please select a numerical value that describes your degree of agreement with one of the choices per question:**

1. A. I believe the online discussion was **important/unimportant** to my learning in online courses.

Important 1      2      3      4      5      Unimportant

Why did you respond this way?

2. Online discussion was **unhelpful / helpful** towards my achievement in online courses.

Unhelpful 1 2      3      4      5      Helpful

Why did you respond this way?

3. I was **unmotivated/ highly motivated** to engage in online discussion.

Unmotivated 1      2      3      4      5      High motivated

Why did you respond this way?

4. Online discussion behaviors were **challenging/ easy** to complete.

Challenging 1      2      3      4      5      Easy

Why did you respond this way?

5. I **did not experienced/ experienced** triggers (prompts) to engage in online discussion forum area.

Did not experience 1 2      3      4      5      Experienced

Why did you respond this way?

Section Two

**Please indicate your degree of agreement with each statement below.**

6. Online discussion forums were an important part of my learning in online courses.

a. Strongly disagree    b. Disagree      c. Neither agree nor disagree      d. Agree      e.  
Strongly Agree

Why did you respond this way?

7. Online discussion helped me learn in online courses.

a. Strongly disagree    b. Disagree      c. Neither agree nor disagree      d. Agree      e.  
Strongly Agree

Why did you respond this way?

8. I was motivated to complete online discussion each week.

a. Strongly disagree    b. Disagree      c. Neither agree nor disagree      d. Agree      e.  
Strongly Agree

Why did you respond this way?

9. I had to overcome obstacles in order to complete online discussion behaviors.

a. Strongly disagree    b. Disagree      c. Neither agree nor disagree      d. Agree      e.  
Strongly Agree

Why did you respond this way?

10. I was prompted to engage in online discussion behaviors.

a. Strongly disagree    b. Disagree      c. Neither agree nor disagree      d. Agree      e.  
Strongly Agree

Why did you respond this way?

APPENDIX D  
INTERVIEW QUESTIONS

**MOTIVATION/ BENEFITS**

1. What were your motivations to complete online discussion requirements? Beyond requirements?
2. Please consider the following common motivations – achievement, recognition, the work itself, responsibility, advancements and growth – which of these motivations did you experience from online discussion and how?
3. Please elaborate on the primary motivators you experienced from online discussion.

**OBSTACLES/ COST**

4. Please consider the following common obstacles – time, effort, probability of failure/ success, external obstacles – which of these did you experience from online discussion and how?
5. Please elaborate on the primary obstacles you experienced from online discussion.

**TRIGGER (PROMPTS)**

- What prompts did you experience or create for yourself for online discussion forums? Where any particularly successful or you wished existed?

**INFLUENTIAL FACTORS****Online behaviors with higher cost than benefit ratio**

6. Were there any online discussion behaviors that had too high of a “cost” than benefit for you? What were they and why? (lack of motivation, excessive obstacle to completion, or lack of trigger?)

**Online behaviors with high cost but higher benefit ratio**

7. Were there any online discussion behaviors that were high cost for you, but offered enough benefit you completed them anyway? What were they and why? (higher benefits/ motivation/ or successful triggering system?)

**Non-rewarding online discussion behaviors**

8. Where there any online discussion behaviors that did not offer any benefit to you or were perceived as “busy work”? (lack of motivation)

**Open ended concluding statements**

9. Could you please rank the influential factors in order from most influential to least influential?
10. Are there any other insights or recommendations concerning online discussion you would like to share?

APPENDIX E  
IRB EXEMPTION



**INSTITUTIONAL REVIEW BOARD**  
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**MEMORANDUM**

**TO:** Audrey Duncan and Walt Woolbaugh  
**FROM:** Mark Quinn *Mark Quinn CJ*  
**DATE:** November 7, 2016  
**SUBJECT:** "The Impact of Online Discussion on Capstone Quality" [AD110716-EX]

The above research, described in your submission of November 7, 2016, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46 section 101. The specific paragraph which applies to your research is:

- (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.
- (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.
- (a) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.
- (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.
- (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.
- (b) (6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.