RELATIONSHIP BETWEEN ONLINE CLASS SIZE AND STUDENT DISCUSSION INTERACTIVITY

Eric Oestmann, PhD, MS, PT
8311 Haven Harbour Way
Bradenton, FL 34212
P. 941.746.5913
Online Senior Faculty
Devry-Keller Graduate School of Management
Email: dreric@oeinet.org
Homepage: www.oeinet.org

Joanna Oestmann, EdD, LMHC, LPC, LPCS
8311 Haven Harbour Way
Bradenton, FL 34212
P. 941.224.1559
Program Area Chair – Counseling & General Human Services
Capella University
Email: Joanna.oestmann@capella.edu
Homepage: www.capella.edu

ABSTRACT
There is a critical need for research related to online education process delivery improvement. Accordingly, the determination of optimal class size has significant implications in relation to maximizing student discussion interactivity. A retrospective study of 30 masters level healthcare management and administration courses delivered between 2003 and 2004 was evaluated for the relationship between class size and average student discussion interactivity. The results indicated a “good” or “moderate” Pearson correlation coefficient of .813 with statistical significance of P=.01 whereby larger (n=25 students) class sizes were representative of higher average rates of individual student participation than smaller (n=12 students) class sizes. Numerous suggestions for future research related to online class size and various contributions toward learning outcomes and course process improvements are noted in the conclusions.

KEYWORDS
Online education, optimal class size, threaded discussions, student interactivity, asynchronous, learning outcomes

I. INTRODUCTION

Colleges and universities in the United States and the world are increasingly using online education. In fact, the Council for Higher Education Accreditation estimated that collegiate enrollment in distance education at 2.2 million students in 2002. Moreover, 38% of accredited collegiate academic institutions offered some form of online distance learning programs or courses in 2002 [1]. As a result of this phenomenal growth in online education it is imperative that the research and practice foci shift to increasing the efficacy of this modality. Specifically, online education providers are engaging in numerous process and delivery improvement based research efforts which commonly involve the topics of optimal class size and learning outcomes.
Hanna [2] reported that the Higher Learning Commission who authorizes the six regional institutional accreditation organizations of online learning is now emphasizing quality measurement programming based on learning outcomes and achieving optimal interaction between learners, teachers, and content. As a result, higher education institutions offering online courses have focused quality process improvements on the optimization of learning outcomes. These efforts have been largely based on methods to increase social interaction among teachers and students according to Smith and Fernyhough [26]. Invariably, these quality programming efforts involve the discussion of optimal class size in online classes that involves Lev Vygotsky’s Socio-Cultural Cognitive Theory.

A. Vygotsky’s Socio-Cultural Cognitive Theory

Vygotsky’s [27] Socio-Cultural Cognitive Theory is the basis for typical online asynchronous courseroom learning assessment techniques in which increased social interaction is directly related to increased cognitive development. In short, Vygotsky’s theory and subsequent research supportive of the theory indicated that increased social interaction among students also increases cognitive development. As a result, asynchronous learning almost unanimously utilizes the courseroom learning assessment technique or modality of discussion threads. In other words, increased discussion interactivity among students and between faculty and students is directly related to learning outcomes. However, the majority of research supporting this theoretical application in online learning does not consider the impact of class size on discussion interactivity.

In application of Vygotsky’s theory, online educational institutions have focused the majority of content delivery systems utilizing discussion threads as a modality to create an atmosphere where students have maximal interaction with other students and instructors in order to optimize learning outcomes and cognitive development. Despite this standard online courseroom modality, online institutions have long searched for research related to the optimal class size in which to optimize social interactivity of the students. Traditional brick and mortar educational institutions have generally found smaller class sizes result in the most interaction between students and faculty, and yet this generalization has yet to be determined if these results are transferable to the online delivery of education according to Parbudyal and William [1]. Consequently, the elusive search for optimal online class size that results in maximal student discussion classroom interactivity continues to be unanswered through process improvement.

B. Online Process Improvement Strategies

Online educational delivery systems are typically judged on the effectiveness to provide quality learning experiences related to the product and the processes involved. Glahn and Gen [3] reported that there is a shift occurring in online teaching from an emphasis on product innovation to process innovation due to the fact that the basic elements of online platform course delivery products are essentially the same. In other words, each online course delivery system has similar mechanisms for synchronous and asynchronous communication, content management and presentation components, student assessment of learning outcomes, and course delivery infrastructure. Despite these similarities in product delivery, the processes involved with the specifics of how online courses are facilitated and taught vary greatly from institution to institution and largely based on class size.

Hicks, Reid and George [4] reported that online education today should be more concerned with the process delivery (e.g., class size) than with the modalities of content delivery which are largely agreed upon. Therefore, online education delivery processes must now take into account the personal dimensions students bring to the learning experience through process evaluation techniques. As a result, the great
debate continues between online and traditional (face-to-face) higher education delivery involving class sizes based on the “no significant difference” learning outcomes research according to Glahn and Gen [3].

C. No Significant Difference Research

Specific research related to the “no significant difference” learning outcomes between online and traditional education venues is ongoing. Sims, Dobbs and Hand, [5] reported that studies have demonstrated both positive and negative impacts in terms of effectiveness and achievement of outcomes between online and traditional higher education delivery modalities. This may directly reflect the fundamental differences in learning styles between the traditional face-to-face and virtual (online) classroom being structural: speaking and listening in the traditional classroom versus typing and reading in the online classroom, [6]. Moreover, studies by Parbudyal and William [1], Driver [7], Dutton, Dutton and Perry [8] all reported that once courses are effectively managed by instructors, online education can be the same quality as, or even better than the regular in-class method due in part to fostering an increase in participation by students citing one of the major limitations of online learning is based on auditory, kinesthetic learners.

Glahn and Gen, summarize the “no significant difference” phenomena by stating, “Online teaching is not better than face-to-face teaching, nor is it worse. It is simply different” [3, p. 777]. Both online and traditional methods of higher education delivery are unique and have their own advantages and disadvantages. However, the goal in both traditional and online educational delivery systems is to maximize the best features of teaching in order to promote optimal active student-centered learning which is directly related to student discussion interactivity and Vygotsky’s Socio-Cultural Cognitive Theory. As a result, the great debate surrounding optimal class size in online education is based on creating the optimal environment in which to maximize student discussion interactivity and potential learning outcomes.

In an exhaustive search of the literature, Achilles, Finn and Bain [28] reported in a traditional higher education classroom setting that small classes (13 to 17 students) compared with regular class sizes (23 to 26 students) provided higher student learning outcomes as determined by final grades also citing anecdotal evidence of more student discussion interactivity in the smaller classes. The authors went on to conclude that economically disadvantaged and some ethnic minorities performed better in smaller classes which is another area for further investigation in online education. Lou, Abrami and Spence [29] also reported increased student achievement in traditional higher education classroom settings favored small group learning sizes. In Abrami, Lou, Chambers, Poulsen and Spence’s [30] latest study involving class size and learning outcomes in traditional higher education classroom settings, the results confirmed previous research findings related to smaller class sizes and higher student learning outcomes. However, the authors state that this is most likely due to the fact that smaller class sizes allow for more social interaction amongst the instructor and student peers which is not as prevalent in larger class sizes.

As a result of the research review, it can be concluded that smaller traditional (face to face) higher education class sizes are related to better learning outcomes and student discussion interactivity. However, this relationship is largely unknown and not researched to date in the online venue of higher education delivery. Consequently, the great debate involving online versus traditional class sizes and learning outcomes related to social interaction (e.g., discussion interactivity) remain to be answered or researched in online education. Grandzol [9] supported this conundrum by advocating for validation of best practices in online education related to optimal class size. However, the looming question that remains to be researched is whether or not class sizes and learning outcomes in traditional classrooms based on size are comparable to online delivery systems?
D. Personal Observations

As an impetus for this research study, the authors have personally taken and taught online collegiate based education courses since 1999. Course sizes have ranged from 5 to 30 students among various institutions offering online education with little or no justification given. Consequently, a recent experience whereby two different sized sections (12 and 20 student) sections of the exact same course taught by the same researcher where perceptual differences in the two sections appeared to have dramatically different response rates in the discussion threads not representative of the percentage difference in the two classes. More specifically, the smaller class size appeared to have a paucity of discussion responses whereas the larger class size appeared to have a plethora of discussion responses, despite a standard requirement to post two responses per discussion question per week. This led the researchers to investigate the relationship between online class size and the average quantity of threaded discussion posts per student as a measurement of student discussion interactivity and knowledge acquisition. Furthermore, an exhaustive search of the literature resulted in no research findings related to class size and student discussion interactivity as representative of learning outcomes in online collegiate education.

E. Research Basis

The relationship between online class size and the average quantity of substantive threaded discussion posts per discussion question per student (e.g., student discussion interactivity as a component of learning outcomes) is unknown. Therefore, the significance and implications for such research supports the need for optimally improving the process delivery of online higher education related to class size and student discussion interactivity. While costs can be easily measured for various online class sizes, the relationship between class size and student discussion interactivity related to learning outcomes is unknown. Therefore, the benefit and purpose of researching this relationship between class size and the average quantity of threaded discussion posts (e.g., student discussion interactivity) is directly related to Vygotsky’s [27] theory in which learning is both situational and collaborative whereby knowledge is acquired through increased interactions with other people. In addition, this information is valuable for online educational institutions in order to evaluate and improve the curriculum and meet the demands of external assessments and/or accreditation bodies. Consequently, faculty, students, administrators and accreditors are interested in achieving maximal student discussion interactivity related to class size given the possibility that differences between the online and traditional face to face delivery methods based on class size may exist.

In researching the relationship between online class size and the quantity of substantive threaded discussion posts representative of class discussion interactivity, the authors have identified many associated assumptions, limitations and delimitations. One important factor considered is related to the differences in terminology and language used throughout online education. However, the authors have attempted to provide various synonymous terms in parenthetical postlude throughout this research. Moreover, the operational definition of threaded discussions is warranted. Threaded discussions are simply a place where students and instructors post questions for discussion and responses in a public arena for everyone to read and react to in the online platform. Nearly all online education programs require student and teacher participation in threaded discussions. Moreover, “substantive” discussion posts involve an assessment of quantity and quality of communication contribution by the student which is further operationally defined in the literature review.

An important assumption of this study is related to knowledge/learning being achieved through increased numbers and quality of student discussion interactivity. Furthermore, this student discussion interactivity is solely measured by the researchers through evaluating and counting average substantive discussion
posts per student which is consistent with Vygotsky’s theory of increased social interaction results in increased cognitive development. An important limitation of this study includes the measurement of online substantive threaded discussion posts being independent of other assignments, projects, tests or quizzes and limited to the scope of masters level healthcare management and administration courses. Another limitation is related to the evaluation of class size and substantive threaded discussion posts based on the product delivery platform eCollege™. Only learners who completed the course are included in the compilation student discussion interactivity statistics for this study. In addition, the limitation of teaching styles among all online instructors involved in this study is learner-centered, andragogical, and Socratic, yet variable in application. Henceforth, minor variations in teaching style, course instructions and expectations outside of the standard requirement of students posting at least two substantive responses to each discussion question of the online course is outside of the scope of this study and limits external validity and generalizability accordingly.

Delimitations will not delineate between teaching experience, age and healthcare management and administration experience. Additionally, student computer proficiency, differences in student computer technology including Internet service, age or experience, predominant learning style, learner satisfaction, learner motivation, personal circumstances, and final grades will not be examined in this study. In addition, the analysis of unsubstantive discussion posts by some students may have an impact on quantity and quality of subsequent discussion posts by other students; it is beyond the scope of this research study and yet may have impact on the external validity and generalizability of findings.

II. LITERATURE REVIEW

In an effort to validate our earlier stated assumptions, four contemporary researchers provide the framework to establish a valid basis for measuring online student knowledge and learning outcomes represented by the quantity of threaded discussion posts.

According to Chen and Hung [10], objective knowledge is collective in nature whereas subjective knowledge is parallel to personal understanding. Moreover, online discussions (a.k.a., Threaded Discussions) support the construction of collective knowledge of the group. Obviously, the highest correlation of knowledge acquisition and subsequent learning outcomes are related to responses to a message and posting of new messages. In addition, Vygotsky [27] reported that knowledge can best be acquired through interaction with others through cooperative activities, of which online threaded discussions are the hallmark for educational cooperative activity for online courses depending on the quality and quantity of electronic discussion contributions.

Jeong [11] studied the content analysis (quality) of threaded discussion posts and summarized that despite the popularity of computer mediated communication (CMC), few theories and little empirical research directly links student interaction and learning processes in online discussions. Therefore, content analysis is one method of focus on the quality of messages in relation to performance in critical thinking and argumentation. Jeong [11] went on to conclude that content analysis cannot be used to examine the relation between threaded messages and how message sequence and group processes affect subsequent discussion and cognitive outcomes.

On the other hand, Grandzol [9] found that successful learning involves learning why certain knowledge is necessary and important through learning what the knowledge actually includes, to learning how to use and apply it primarily occurs in discussion forums with secondary emphasis on learning units, assignments, quizzes and tests. Therefore, this research supports the measurement of class discussion interactivity in online classes of various sizes as the most significant variable associated with learning outcomes.
Wu and Hiltz [12] carried on this research theme and their results indicated that online discussions do improve students’ perceived learning when they are constructed in accordance with collaborative learning environment structure. In other words, the discussions should persist throughout the week and motivate students to be more engaged in their course and learning. Moreover, the active participation in online discussions should be student-dominated rather than instructor-dominated. This will be discussed in greater detail later in the literature review.

In addition to the quantity of threaded discussion posts being a direct representation of online learning, there is also the consideration for the quality and types of messages posted in the discussion threads which are more or less representative of knowledge acquisition. More specifically, Bakeman and Gottman [13] created a differentiation between twelve different types of messages based on quality of response. Bakeman and Gottman confirmed that different types of discussion thread responses are linked to different probabilities of sequential interactions and responses among students. However, most important is the difference between what is referred to as “substantive” and “unsubstantive” discussion posts in terms of knowledge acquisition in the online environment.

Jarvela and Hakkinen [14] researched the categorical distribution of postings into theory, new point/question, experience, suggestion and comments as opposed to the twelve qualitative realms established by Bakeman and Gottman [13]. Of these four distributions, the discussion postings were further divided into high-level, progressive and lower-level categories. Interestingly enough, 64% of postings grouped into high-level and progressive posts whereas 36% of postings were lower-level. Given the very limited sample in Jarvela and Hakkinen’s [14] research this may only lead the researcher to conclude that there is the possibility of nearly a third of postings being categorized as unsubstantive.

For the purposes of this research study, unsubstantive threaded discussion posts will be excluded in the quantitative calculations as these do not represent significant student discussion interactivity related to learning or knowledge acquisition. While unsubstantive discussion posts by some students may have an impact on quantity and quality of subsequent discussion posts by other students, it is beyond the scope of this research study. Further discussion as to what is considered unsubstantive will be delineated in the methods section. However, there is yet another consideration in the process effectiveness of online learning to consider related to how knowledge is acquired related to the epistemological structures and forms which can be infused into online discussions to maximize knowledge and student discussion interactivity therefore warrants consideration related to learning outcomes. Hicks, Reid, George advocate the constructivist approach to teaching and learning which is “the critical feature of all successful learning environments” [4, p.144]. Moreover, there is a misconception in the online education community as to “effective pedagogical” epistemology.

From a purely pedagogical constructivist paradigm information is transferred from the instructor to the student. Consequently, there are major concerns about the lack of complexity and depth of this method in relation to learning outcomes as well as facilitation for online discussions [1]. Moreover, this lack of interaction demonstrated in pedagogical teaching methods has been shown to decrease social interaction among the students which concomitantly decreases cognitive development (e.g., learning outcomes) according to Smith and Fernyhough [26]. The authors based their findings related to pedagogical teaching challenges on Vygotsky’s research works related to social interaction. Additional problems identified with pedagogical teaching methods also included bias, student isolation and negative impact on team and inter-personal skills. Therefore, even though teaching methods are often referred to as “pedagogical online approaches”, it is actually more correct to identify online learning that includes socially interactive discussion thread posting as andragogical, Socratic or learner-centered which embraces experiential learning, social interaction and increased cognitive development.
Wiesenber followed online learner-centered teaching methodology from its earliest beginnings to contemporary practice and found a paradigm shift from being “other-directed” as in pedagogical teaching methods; to “self-directed” as in independent learning; to “mutually-directed” as in andragogical teaching methods [6, p. 151]. In other words, Wiesenber found that early online education methodologies initially adopted a role as the expert, then shift to less directive roles as learners interact with each other. Consequently, adult educators can act as co-learners, reflective practitioners and researchers to optimize learning and thread discussion participation to remain consistent with Vygotsky theoretical constructs. In addition, due to the very face-to-face nature of traditional classrooms, this may actually suppress the expression of individualistic or nonconformist thinking, whereas online classrooms allow learners to take time to reflect, write and rewrite their contributions before offering them to the class discussion. More importantly, this may explain the preliminary and anecdotal differences experienced by the researchers in this study whereby larger online class sizes actually stimulate and encourage more student discussion interactivity as opposed to the traditional face-to-face class room research studies where the opposite effect is reported.

Knowledge acquisition is the fundamental measure of learning. However, learning outcomes are somewhat broader in measurement and scope. Ideally, learning outcomes refer to the combination of subjective and objective knowledge in addition to synthesis of this knowledge and application in real-world situations and measured by final grades and/or test scores. To that end, maximizing the threaded discussion continuance is a balance between the instructor participating too much and not enough according to Matthews and Doubler, [15]. Within the Devry-Keller Graduate School of Management online faculty facilitation requirements it is standard for online instructors to respond to at least every 5 student discussion posts. In addition, it is recommended that discussion summaries are provided with follow up questions for students; moderation and redirection of posts is provided when student responses are off the subject; guidance is provided by the instructors with real world application among the topics of discussion; instructors prompt student follow-up responses with open-ended questions; instructors mediate the resolution between conflicting views among students; instructors problem solve and eliminate/prevent inappropriate discussion messages; and instructors follow-up with students who are non-responsive in the courseroom discussion threads. While these instructions are provided to maximize student discussion interactivity and learning outcomes, the research literature is scant to support or refute this relationship, and yet it provides a baseline for student discussion interactivity facilitation techniques for all online instructors.

The aforementioned online environment and course facilitation techniques designed to maximize student discussion interactivity is referred to as a “Collaborative Learning Environment”. Billings, Connors, Skiba [16] define a collaborative learning environment (aka “Active Learning or Learner-Centered Environment) as one which allows students to engage in the learning process in thoughtful and analytic information processing. Experiential learning may also be attributed as a characteristic of this model whereby individual experiences are reflected in student contributions to class. In their study, online students perceived that they were more actively involved in learning than they were in traditional face-to-face courses [16]. This is often achieved by directing discussion questions and follow-up questions using the higher levels of “Bloom’s Taxonomy”.

In 1964, Bloom, Mesia and Krathwohl published differentiation in taxonomic levels of instructor based questioning that is correlated with levels of student learning [17]. Higher levels of learning related to comprehension, synthesis, application, and analysis are associated with instructor queries like “compare and contrast”, “distinguish between”, “analyze the pros and cons”. On a more specific level Blignaut and Trollip [18] discovered that instructor responses to online student discussions that are Socratic, informative and corrective are related to learning and learner satisfaction although considerable variation in teaching styles, interaction and the amount of content-related feedback was noted. Grandzol [9] also
concluded that effective online education is inherently student centered whereby the students actually may direct the learning process with various forms of faculty facilitation.

Now that the attention has shifted from product innovation to process innovation in online teaching and learning, more emphasis is now placed on refining the collaborative learning venues that facilitate optimal student discussion interactivity and achievement. Glahn and Gen go on to state that “One of the best attributes of the online environment is its ability to offer asynchronous teacher-student communication, a hallmark of online teaching” [3, p. 781]. Moreover, students who would not otherwise engage instructors in traditional teaching environments, are more apt to do so in an asynchronous environment. “Research shows that students who engage in collaborative learning and group study perform better academically, persist longer, and improve their communication skills…” [3, p. 782]. Therefore, Vygotsky’s original theoretical constructs continue to be reflected with the facilitation instructions for online collaborative learning environments which maximize social interaction through online student discussion interactivity which in turn maximizes student cognitive development.

Kling and Courtright [19] refer to a “sociotechnical” model in which collaborative learning environments operate. These authors again support Vygotsky’s theory where learning is acquired through social interaction and extend it to the technical online environment where learning is situated. The end result refers to an integration of social and technical elements that maximizes interaction and learning by creating a virtual community online. A collaborative learning community based on the sociotechnical model is one in which there are social ties, perceptions of similarity, and common beliefs among other factors. Successful communication in virtual communities therefore appears to be related to a sense of mutual engagement and openness among members. Kling and Courtright went on to identify additional characteristics that foster collaborative learning: (a) where everyone feels they belong and are respected, (b) where interaction is ongoing, regular and focused around common goals, and (c) a cohesive yet self-reflective group [19, p. 225].

All of the aforementioned studies contribute to optimally effective collaborative learning communities [20]. Moreover, the interactivity in online education is what directly relates to student success and learning according to the authors [20]. In concert with these conclusions, Sims, Dobbs and Hand reported that interactivity, and the quality of this interactivity is about successful communication and “one of the most crucial success factors” [5, p. 143]. Interactivity between the learners; learner-teacher; teacher-learner; and learner-content is critical to the overall effectiveness of the online education experience and inexorably linked to potential learning outcomes. Learning satisfaction is also related to student discussion interactivity and related learning outcomes.

According to Long and Javidi [21], online participation is a significant indicator of student performance based on overall grade point average (i.e., learning outcomes). Other reports by Althaus [22] and Stith [23] also suggest that online participation is an indicator of performance. However, Stith went on to discover that the number of student visits to the class web site did not correlate with grades [23]. Henceforth, one can conclude that site surfing does not equate to learning. Moreover, Long and Javidi report, “It is clear that the frequency of online participation is a predictor of performance as measured by examination grades” [21, p. 19]. Interestingly, Long and Javidi’s research reported the frequency of student performance is also correlated with overall grade point average. In addition, online students who have higher reading and writing aptitudes and skills tend to make higher grades and will probably participate more in online discussions, again increasing student interactivity, according to the authors [21].

Billings, Connors and Skiba, [16] went on to summarize that learning outcomes are associated with variables related to connectedness, socialization and student satisfaction. In their study, isolation (or lack of connectedness) is negatively correlated with satisfaction and socialization ratings of online students.
whereas active learning is positively correlated with feedback, student-faculty interaction and student interactivity. This is optimally achieved with educational practices of andragogy that encourages active learning, prompt feedback and collaboration and interaction among peers. Finally, technology contributes to the efficiency of learning with hardware and software that are reliable and efficient. Hicks, Reid and George, [14] supported this by summarizing the role of technology in learning is to provide a flexible learning environment which supports student learning and student discussion interactivity rather than the transmission of knowledge and ideas passively as done in traditional pedagogical face-to-face course room teaching methodologies.

In conclusion, the literature review has firmly established the optimal tenets for maximizing student discussion interactivity in the online environment and its relationship to class size. Consequently, online academic quality is driven by the successful enabling of learning through interactivity among faculty members and students [9]. As a result, various learner-centered online class sizes would be expected to impact student discussion interactivity which could be associated with learning outcomes consistent with Vygotsky’s theory. However, the relationship between online class size and student discussion interactivity is unknown.

III. METHODS

The purpose of this study is to examine the relationship between class size and average discussion posts per question per learner (e.g., student discussion interactivity) during an online course term. The design of this study is retrospective and quantitative in nature. While many previously mentioned studies in this report related to online learning outcomes were survey or qualitatively based, the lack of quantitative research in determining the relationship between class size and student discussion interactivity is needed.

This research study is based on a retrospective analysis of substantive discussion posts for 30 sections of masters level healthcare management and administration courses from 2003 to 2004 at a large private online university using the asynchronous delivery platform eCollege™. The nature of this retrospective study created a situation that did not directly involve human subjects and was approved exempt from the Devry-Keller Institutional Review Board. However, confidentiality and anonymity of the participants and university was maintained in order to comply with the Family Educational Rights to Privacy Act (FERPA) regulations.

The sample for this research was obtained using a convenience technique. The convenience of the researchers to access course discussion posts from the previous two years of masters level healthcare management and administration courses was governed by the archives available on the institution’s computer server. The sample included the examination of discussion posts for 6 different healthcare management online courses taught by 5 different instructors in order to increase the validity and generalization of this study. Moreover, the quota of 30 courses (subjects) provides adequate sample size for most quantitative statistics as well as establishing strong content validity according to Portney and Watkins [24]. The total number of students for these 30 classes was 559. Individual class sizes ranged from 12 to 25 students.

Limitations of this sample included the fact that discussion posts were only included among those who completed the course. Other limitations include the fact that there were 6 different graduate level healthcare management and administration courses taught by 5 different instructors at the university. No consideration for differences between age and experience of the instructors is given. However, the initial discussion questions are standardized by the university. Subsequent discussion threads posted by the 5 different instructors are not standardized with the exception that all are trained in the methods outlined in
the literature review regarding the creation of a collaborative learning community consisting of substantial percentages of Socratic feedback during initial faculty development training. Moreover, the university dictates that students post at least two contributions to each discussion question for the week in order to earn maximum discussion points as well as instructor posts at least every 5 student discussion posts which was consistently complied with by the instructors for all classes included in this study.

Data collection consisted of the two authors of this research study accessing the discussion posts for the 30 sections of masters level healthcare management and administration courses taught from 2003 to 2004. Each researcher independently assessed and tallied both “substantive” and “unsubstantive” discussion posts per learner who completed each course. The “unsubstantive” discussion posts were not included in the discussion post averages, but recorded separately in order to facilitate inter-rater reliability. This procedure was repeated three times by each researcher and an average value was calculated to enhance the intra-rater reliability established at the threshold of >0.90 which was complied with for all 30 sections evaluated in this study. Although, non-substantive posts occurred in the courses evaluated, they are beyond the scope of this study.

Moreover, the concurrent validity of this study was enhanced by the fact that each researcher independently determined the average of “substantive” discussion posts per learner in all 30 course sections. One of the researchers has significant background in healthcare management and education in addition to online teaching whereas the other researcher’s background is not related to healthcare management, but does have significant experience in online education. Differences between the two researcher’s “substantive” discussion post averages were also examined using reliability correlation coefficients to further establish inter-rater reliability and validity of this study maintaining >.90 value. The face validity of this study is established by the literature review in determining what variables should be compared and which variables are most representative of learning outcomes (knowledge acquisition).

Next, the class sizes were compared with the average “substantive” discussion post number per student (e.g., student discussion interactivity) using Excel™ and SPSS™. First, the data was input into a scattergram graph to determine parametric or nonparametric design as shown in Table 1. As indicated, parametric representation and linear relationship as determined by a line of best fit supports the use of a Pearson correlation coefficient analysis according to Portney and Watkins [24]. Moreover, this statistical measure shows the strength and direction of each variable which will be valuable in meeting the purpose of this study which is related to determining optimal online class size and student discussion interactivity. Again, Pearson correlation coefficient analysis utilizes interval or ratio level data which is represented by the two variables of class size and average substantive discussion posts per learner (e.g., student discussion interactivity).

Table 1: Scattergram of Class Size and Average Discussion Posts Per Question Per Learner
IV. RESULTS

Basic research findings supported a linear relationship as identified on scattergram between class size and average substantive discussion posts per learner as shown in Table 1. Descriptive statistics are included in Table 2 showing the class size ranging from 12 to 25 students with an average discussion post per student representation of 2.12 in the smaller class size (n=12) and an average discussion post per student representation of 6.58 in the larger class size (n=25).

![Class Size & Student Discussion Interactivity](image)

**Table 2: Descriptive Statistics**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLASSSZ</td>
<td>30</td>
<td>12.00</td>
<td>25.00</td>
<td>18.6333</td>
<td>3.89945</td>
</tr>
<tr>
<td>AVEPOSTS</td>
<td>30</td>
<td>2.12</td>
<td>6.58</td>
<td>4.3393</td>
<td>1.26676</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A two-tailed Pearson correlation coefficient analysis was applied to the two variables in this study using SPSS™. The results are detailed in Table 3. According to Portney and Watkins [24], Pearson correlation coefficient values above .75 are considered “good” to “excellent”. Sproull [25] supports this with the report that Pearson correlation coefficient values between .85 and 1.00 are “high” whereas those between .50 and .84 are “moderate”. Moreover, the use of two tailed Pearson correlation coefficients are appropriately used when the direction of effect is unknown as indicated by the research hypothesis.

**Table 3: Pearson Correlations**

<table>
<thead>
<tr>
<th>CLASSIZE</th>
<th>Pearson</th>
<th>CLASSIZE</th>
<th>AVEPOSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>.813**</td>
</tr>
</tbody>
</table>
Given the statistical analysis in Table 2, there is a positive correlation between class size and average substantive discussion posts per question per learner in the 30 sections of healthcare management and administration online courses. Furthermore, this correlation is qualitatively described as “good” or “moderate” in strength. In other words, there were more substantive posts per discussion question per learner in larger online courses (n=25) than in smaller courses (n=12).

V. DISCUSSION

Despite assumptions, limitations and delimitations cited earlier in this study, the results of this study provide previously unavailable comparisons in the relationship between class size and number of substantive discussion posts (e.g., student discussion interactivity). Moreover, the research data indicates that online courses similar in content achieve greater measures of social interaction and learning opportunities (as represented by the average number of substantive posts per discussion question per learner) with larger class sizes (n=25 students) as opposed to smaller class sizes (n=12 students). Therefore, the relationship previously reported in research literature regarding smaller class size in traditional face-to-face settings is not supported in the online environment for this sample population. Rather, this research indicates larger class size in the online venue is associated with increased student interactivity. It is important to also understand the primary differences in measuring student discussion interactivity between traditional face-to-face (i.e., verbal communication) and online (i.e., written communication) venues which may explain in part the differences noted. This information not only provides valuable data regarding social interaction and learning opportunities, it also provides information with which online administrators may want to structure course sizes. In addition, insight was gained to address the optimization and best practices on online learning.

Wiesenberger reported that one of the primary benefits of online learning is “increased peer interaction due to a collaborative rather than a competitive learning environment” “increased interaction with more accessible teachers with decreased feedback turn-around time” “increased quality of learning with deeper critical reflection and systematic scaffolding of ideas taking place” [6, p. 150]. The research results herein appear to support Wiesenberger’s findings as well as Vygotsky’s theory related to increased online class size and increased student discussion interactions resulting in the potential for increased learning outcomes.

As online educational organizations have shifted their focus from innovative online product development to an increase in process innovation and development, studies showing optimal effectiveness (best practices) will become more and more important and valuable related to benchmarking in the industry. According to Billings, Connors and Skiba, benchmarking is essentially a research approach that discovers “best practices” in processes to promote quality, effectiveness, and success that is “adopted infrequently in the higher education arena” [16, p. 42]. Benchmarking variables in online education are identified as: (a) outcomes (learning), (b) educational practices (andragogy), (c) use of technology to assist in helping students feel connected and promote socialization as opposed to isolation. Consequently, the results of this study can be used to strengthen or improve learning outcome strategies accordingly.
VI. CONCLUSIONS & RECOMMENDATIONS

Larger online graduate healthcare management courses (n=25) resulted in significantly increased student discussion interactivity. Reasons for more student discussion interactivity in larger online graduate healthcare management classes (n=25) may relate to stimulated collaboration, less intimidation, or a need to be heard among others worthy of future research. Whereas, smaller online graduate healthcare management courses (n=12) resulted in significantly decreased student discussion interactivity. Reasons for less class discussion interactivity in smaller online graduate healthcare management classes (n=12) despite the standard instructor instructional requirement of at least two discussion posts per question may relate to intimidation or decreased self-efficacy among other reasons again worthy of future research.

While the online class sizes in this research study ranged from 12 to 25 students, the authors have taught classes ranging from 4 to 40 students indicating a wider sample range to test in future research. In addition, the authors are unable to extrapolate the data beyond an upper limit online class size with more than 25 students as this data was unavailable in this study. While student discussion interactivity continued to rise with the size of the online classes up to 25 students, only at a point where student discussion interactivity would begin to drop could one ascertain the truly optimal class size. The practical application for online instructors and administrators for determining optimal class size is related to costs of course staffing or payment structure as well as maximizing learning outcomes in an environment that maximizes student discussion interactivity. Therefore, additional research is needed to assess larger class sizes and the truly optimal class size and related to maximal student discussion interactivity.

A significant amount of research has been done in online and traditional higher education environments related to learning outcomes and class size, therefore a broader scope of this research to include more specific measures of learning outcomes is warranted. Specifically, learning outcomes as measured by test scores, final grades or degree completion may provide further data supporting or refuting Vygotsky’s theory where increased learning is dependent on increased student discussion interactivity related to online class size.

Jarvela and Hakkinen [14] concluded that while both students and instructors report superior learning opportunities and outcomes online, one of the clear relationships correlates improved outcomes on faculty efforts and skill in teaching online. Palloff and Pratt [20] discussed two primary methods of evaluating student learning: summative and formative. Formative evaluation is therefore meant to encourage better learning related to faculty efforts and skill mentioned by Jarvela and Hakkinen [14], whereas summative evaluation is meant to determine the results of those efforts traditionally steeped in student satisfaction surveys. Since several studies have already related student satisfaction and learning outcomes, the skill and experience teaching online may indeed be worthy of further research study related to determining optimal class size and student discussion interactivity.

Additionally, Wu and Hiltz stated in their research that student’s perception of motivation and enjoyment did correlate significantly with higher reported perceptions of learning from online discussions [12]. Moreover, instructors play an essential role in promoting students’ motivation and enjoyment of online learning. Given these facts, the representation of more discussion postings per learner would also appear to be a direct measure of motivation and enjoyment as well.

The authors of this research plan to continue this line of research with other areas of higher education curriculum to determine if the results are consistent. In addition, as the number of courses taught online continues to grow there will be opportunities to determine specific differences between individual instructor teaching styles and/or singular course content related to class size and student discussion.
interactivity. Furthermore, the relationship between the social interaction as measured by substantive posting responses and persistence, retention and degree completion success also provide related research opportunities. As these recommendations for continued research relates to determine best practices in online learning courses, the Internet delivery method of teaching and learning in higher education will continue to have profound development in the process delivery.

Therefore, it is with great zeal that the researchers encourage further research efforts in order to adopt the most beneficial teaching and learning strategies to maximize learning outcomes and student success. With a commitment to appreciative inquiry, faculty and administrator driven research can and will find better ways to deliver online education supporting maximal student discussion interactivity and optimal class size in the future.

VII. REFERENCES


**VIII. ABOUT THE AUTHORS**

**Dr. Eric Oestmann** has taught a variety of healthcare management/leadership and economics courses in the higher education online classroom since 2001 with Devry-Keller Graduate School of Management. Currently Dr. Oestmann is continuing a career online teaching, consulting, and writing.

Dr. Oestmann has a PhD in Health Services Administration from Southwest University (1999); MS in Physical Therapy from the University of South Dakota (1995); and BS in Composite Science/Management from Black Hills State University (1992). Dr. Oestmann is also near completion of a second PhD in Health Services Administration designed to validate his original “grounded theory” dissertation related to healthcare management and leadership motivation strategies and the economic impact of such applications in healthcare.

Dr. Oestmann has 7 years of experience in healthcare management and 10 years of healthcare management consulting for Reo Healthcare Consulting. The majority of this healthcare related experience involved evaluation and improvement strategies related to the improvement of quality care delivery, organizational profitability, and personnel productivity. In addition, Dr. Oestmann was a practicing physical therapist for 7 years and has 6 years of military management experience in the United States Air Force. Dr. Oestmann has also been a member of the American College of Healthcare Executives (ACHE) since 2001, and an ACHE Student Chapter Faculty Advisor since 2004.

**Dr. Joanna Oestmann** has taught a variety of clinical counseling, human development and human services courses in the higher education classroom since 1997 and in the online environment since 2000. Currently Dr. Oestmann is continuing a career in online education as the counseling and general human services chair for Capella University.

Dr. Oestmann has an EdD in Counseling Psychology from the University of Sarasota (2000); MA in Counseling Psychology from the University of Georgia (1985); and BA in Counseling Psychology from Eckerd College (1981).

Dr. Oestmann has nearly 20 years of experience in counseling psychology and has numerous clinical affiliations, certifications and supervisory roles in the field. Dr. Oestmann continues to be an active member of the American Psychotherapy Association, American Counseling Association, American Mental Health Counseling Association and the Association for Assessment in Counseling.