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Engaging undergraduate students in an online science course: the relationship between instructor prompt and student engagement in synchronous class sessions

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ENGAGING UNDERGRADUATE STUDENTS IN AN ONLINE SCIENCE COURSE: THE RELATIONSHIP BETWEEN INSTRUCTOR PROMPT AND STUDENT ENGAGEMENT IN SYNCHRONOUS CLASS SESSIONS

A dissertation submitted in the partial satisfaction

of the requirements for the degree of

Doctor of Education in Learning Technology

by

Todd C. Shoepe

March, 2013

Paul Sparks, Ph.D. – Dissertation Chairperson

This dissertation, written by

Todd C. Shoepe

under the guidance of a Faculty Committee and approved by its members, has been submitted to and accepted by the Graduate Faculty in partial fulfillment of the requirements for the degree of

DOCTOR OF EDUCATION

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Jack McManus, Ph.D.

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DEDICATION PAGE

The last time I dedicated a large piece of educational material I simply stated the following "This project is dedicated to my family. Enough said." While the notion still holds, it is hardly neither comprehensive nor profound enough to capture all that I feel to those that have supported me throughout my life.

To my mother who couldn't possibly love her family more than she does. You are the cornerstone and spirit of who we are and how we should continue to be. You are selfless in everything that you do and never seem to get the credit that you deserve. There is no better person to exemplify consistency of attitude, disposition, as well as your love for and treatment of others.

To my father who is the most generous person that I know, you hold the most sincere convictions of right and wrong that any could adhere to. Thank you for all the years of sacrifice and hard work on our behalf in order to leave a legacy that included an opportunity for a better life and the insurance that we could take chances to pursue what brought us joy.

To my brothers, I've said this before, but I am equal parts both of you. I don't know how someone could be so fortunate to find such true friends and confidants. Perhaps it was from the years of fighting over whether or not going to the restroom relinquished your claim to a couch. I don't know what "it" was that got us to this point, but I hope that you are able to pass "it" on to your children so that they can too appreciate a lifelong dedication to one another as you have provided to me.

To all of my grandparents, thank you for being a part of the "Greatest Generation." No one born to Generation X, Y, or Z could possibly fathom the dedication

to sacrifice for a nation and a way of life like you. Thank you for tirelessly providing for others by the sweat of your brow and the skin of your knuckles so that my generation might provide for others through more cognitive means in air-conditioned offices.

To my adopted Orange County family, I am most appreciative of the open-armed welcome that you extended to me so many years ago. The more family, the better and you are truly wonderful people who have accepted me for who I am, helped me assimilate California into my life and continue to ground me in all that is good.

Lastly, to my beautiful S.P. I close my eyes each night hoping that I will wake up next to you so that I might be able to spend yet another day in step with you in life. Continuously you extend all the perimeters of what I had even considered possible. The experiences and adventures that we have had together, the people that you have allowed me to meet, and the person that I have become is largely attributable to you. I am so grateful that you took a chance with a meathead so that you might help him question every value, custom, and belief that he previously held only to come out stronger and more fulfilled because of it. I love the challenges you put before me, the confidence you display in my abilities and potential, and your unwavering certainty that we will grow old together. Thank you for being my biggest fan, my best friend, and my partner in forever.

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No research is ever performed in a vacuum and I want to thank each and every person integral to the completion of this project. Not exclusively (with apologies for those not addressed below), these include the following.

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Nick Mattos went above and beyond the expected responsibilities of a colleague in a short timeframe during the data analysis portion of this project. Thank you for not only your labor, but for being such a collegial and supportive partner.

Thank you to my Loyola Marymount University co-workers in every way. Thank you for the internal infrastructure and support necessary to complete a project of this length and magnitude. The Department of Health and Human Sciences is an exciting place to live and work which is the reason that so many hours of intense sacrifice have been able to be completed in such a short time. To my friends and former supervisors Dr. Jim Landry and Dr. John Dorsey along with my current supervisor Dr. David Ramirez, this has been a long ride that would not have been possible without your understanding and support. To my colleague and good friend Joe Russo, I appreciate your help in all technological issues that were useful in completing the delivery of these courses. You have truly played a large roll in opening doors of possibility over the past six years that it would have been unlikely I would have walked through without your help.

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well. Thank you Dr. Stephanie August for extending a hand within the college towards an eager and ambitious fixed-term faculty member. Your mentorship and supportive, interdisciplinary teamwork has allowed me to see great future potential in more things that I could have predicted. To Dr. Jack McManus, I have admired your continued passion and widespread experience for some time. Thank you for lending your services, intellect, and altruism in the benefit of this project. To my dissertation advisor and friend Dr. Sparks, I can't see how this could have gone any other way. I thank you for being a great advocate for me and seeing something early on that opened your door for me to walk through. While this process been a long one, it seems too short in that the formality of this relationship comes to a close. I hope that the future might hold great opportunity for synergistic collaboration and social engagements.

A final thank you to those who have inspired me over the years who perhaps would otherwise go unmentioned. I have been extremely fortunate to be exposed to exceptional mentors who took a chance on me and in doing so were able to model exceptionalism, professionalism, intelligence, compassion, or leadership. These include Cody Carson, Ed Coughlin, Kent Dorsey, Josh Friedman, Mr. Jaffee, Steve and Kathy Lawton, Mark Marchese, Greg McKelvey, Kathleen McMullen, Walt Ream, Jason Wallis, Jeffrey Widrick, Anthony Wilcox, Bill Winkler, Don Worth, and Ron Zaraza. Thank you for being authentically awesome in your own ways.

VITA

Education

Ed.D.	Learning Technology Dissertation: *Engaging students in an online science course: the relationship between instructor prompt and student engagement in synchronous class sessions*	Pepperdine University, 2012
M.S.	Exercise Physiology Minor: Biochemistry/Vertebrate Physiology Thesis Title: *Contractile function of single muscle fibers from chronically resistance trained humans*	Oregon State University, 2001
B.S.	Health and Human Performance Option: Fitness Program Management	Oregon State University, 1998

Professional Experience

2008-Present	**Loyola Marymount University** Assistant Clinical Professor – College of Science and Engineering
2012-Present	Faculty Associate - Center For Teaching Excellence
2011-2012	Master Teacher – Center For Teaching Excellence
2005-2007	Visiting Professor – College of Science and Engineering
2008-Present	**McGraw-Hill Publishing** Consultant – Digital Media Subject Matter and Design Expert
2010	**Burrston House Limited for Delmar Cengage Learning** Consultant – Anatomy and Physiology Textbook Development
2001-2005	**Oregon State University** Faculty Instructor - College of Health and Human Sciences
2001-2005	Course Coordinator – Lifetime Fitness for Health
2001	Strength and Conditioning Intern - Football, Oregon State University Athletic Department
1999-2001	Graduate Research Assistant - Muscle Physiology Laboratory
1999-2001	Graduate Teaching Assistant – Department of Exercise and Sport Science
1997-2003	Group Exercise Instructor - Faculty/Staff Fitness Program
1998-2000	**Fitness Over 50** (Corvallis, OR) Group Exercise Leader/Trainer
1997	**Hanscom Air Force Base** (Boston, MA) Intern

1997 **Albany Athletic Club** (Albany, OR)
Intern

Peer-Reviewed Publications

***indicates undergraduate co-authors mentored by Todd C. Shoepe**

As Author:

1. *Ligouri, G.C., **Shoepe, T.C.** & Almstedt, H.C. (2012). Whole body vibration training is osteogenic at the spine in college-age men and women. *Journal of Human Kinetics, 31*: 55-68.

2. **Shoepe, T.C.,** Ramirez, D.R., Rovetti, R., *Kohler, D.R., & Almstedt, H.C. (2011). The effects of 24 weeks of resistance training with simultaneous elastic and free weight loading on muscular performance of novice lifters. *The Journal of Human Kinetics*, *29*: 93-106.
(Awarded Publication of the Year by the Journal of Human Kinetics)

3. Almstedt H.A., *Canepa, J., Ramirez, D.A. & **Shoepe, T.C.,** (2011). Changes in bone mineral density in response to 24 weeks of resistance training in college-age men and women. *Journal of Strength and Conditioning Research*, *25(4)*: 1098-1103.

4. **Shoepe, T.C.,** Ramirez, D.A. & Almstedt H.C. (2010). Elastic band prediction equations for combined free-weight and elastic band bench presses and squats. *Journal of Strength and Conditioning Research, 24(1): 195-200.*

5. **Shoepe, T.C**., Stelzer, J.E., Garner, D.P., & Widrick, J.J. (2003). Functional adaptability of muscle fibers to long-term resistance exercise. *Medicine and Science in Sports and Exercise*, *35(6)*: 944-951.

6. Widrick, J.J., Maddalozzo, G.F., Lewis, D., Valentine, B.A., Garner, D.P., Stelzer, J.E., S**hoepe, T.C.,** & Snow, C.M., (2003). Morphological and functional characteristics of skeletal muscle fibers from hormone-replaced and non-replaced post menopausal women. *Journal of Gerontology: Biological Sciences*. *58(1)*: 3-10.

7. Widrick, J. J., Stelzer, J.E., **Shoepe**, **T.C.,** & Garner, D.P., (2002). Functional properties of human muscle fibers after short-term resistance exercise training. *American Journal of Physiology: Regulatory Integrative and Comparative Physiology, 283*: R408-R416.

Other Publications

***indicates undergraduate co-authors mentored (or co-mentored) by Todd C. Shoepe**

As Author:

1. Valasek, S. & **Shoepe, T.C.,** (2012). Reducing error in estimating caloric intake: A Comparison of two educational modalities. A Senior Honors Thesis at Loyola Marymount University.

2. Greenfield, D., Blue, D., & **Shoepe, T.C.** (2011). Leadership styles of educational non-profit institutions. *Proceedings of the 10th Annual Hawaiian International Conference on Education*, 620-670.

3. Ott, J., Beard, M., Blue, D., Cleugh, C., Greenfield, D., Lee, T., Lesser, D., McBride, D., Pham, P., Shin, E., Pham, P., **Shoepe, T.,** Turner, R., Viltz, M., Williams, O., & Stager, G. (2010). Examining internet filtering policies and practices to increase student technological learning opportunities (*White Paper).* Published online at *Educational News*, accessed 7/21/10: http://www.educationnews.org/ed_reports/95634.html.

4. **Shoepe, T.C**. (2010). Human cadaver laboratory proposal. *American Physiological Society Archive of Teaching Resources*, http://www.apsarchive.org/index.cfm.

5. **Shoepe, T.C.** (2008). Summary of workshops #108 and #612: Creating visual anatomy exams on Blackboard™. *HAPS-Educator: Journal of the Human Anatomy and Physiology Society*, *12(3)*: 26-27.

As Contributor:

1. **Shoepe, T.C.** & August, S.E., (2012). *iEnergy™ Mobile phone dietary assessment application* (Version 1.0) [computer Software]. Los Angeles: Department of Health and Human Sciences, Human Performance Laboratory, Loyola Marymount University.

2. McGraw-Hill, (2010). *Connect Online Course Management System*. (Version 2.0) [Computer Software]. New York: McGraw-Hill.

3. Medical College of Ohio, (2010). *Anatomy and Physiology Revealed* (Version 3.0) [Computer Software]. New York: McGraw-Hill.

4. McGraw-Hill, (2010). *LearnSmart*. (Version 1.0) [Computer Software]. New York: McGraw-Hill.

Invited Reviewer:

1. Manuscript Reviewer for *Anatomical Sciences Education*, 2012

2. Lankford, R. *Anatomy & Physiology: A Synergistic View.* Delmar Cengage

Learning, Florence, KY: (pending).

3. McConnell, T. (2010). Human Form, Human Function: Essentials of Anatomy and Physiology Lippincott Williams and Wilkins, Baltimore, MD.

Peer-Reviewed Abstracts

***indicates undergraduate co-authors mentored (or co-mentored) by Todd C. Shoepe**

1. *McDonald, K.G., Grote, S., & **Shoepe, T.C.** (2012). Effect of training mode on post-exercise heart rate recovery of trained cyclists, *Southwest Chapter Meeting of the American College of Sports Medicine,* poster presentation.

2. Ramirez, D.A., Brown, L.E., Almstedt, H.C., Kersey, R.D., & **Shoepe, T.C.,** (2012). Effects of ankle supports on vertical jump and mental perception. *Southwest Chapter Meeting of the American College of Sports Medicine,* poster presentation.

3. **Shoepe, T.C., ***Cavedon, D.K., *Derian, J.M., *Levy, C.S., & *Morales, A. (2012). Engaged technology and experiential learning: the effectiveness of iPads and digital microscopy on student performance. *Human Anatomy and Physiology Annual Conference*, poster presentation.

4. Ramirez, D.A., Brown, L.E., Almstedt, H.C., Kersey, R.D., & **Shoepe, T.C.,** (2012). Effects of ankle supports on vertical jump and range of motion. *Far West Athletic Trainer Association Annual Conference*, poster presentation.

5. *Cavedon, D.K., *Derian, J.M., *Levy, C.S., & *Morales, A. & **Shoepe, T.C.** (2012). Educating the future athletic trainer: The effectiveness of iPads and digital microscopy on student performance in anatomy lab. *Far West Athletic Trainer Association Annual Conference*, poster presentation.

6. *Valasek, S., *Derian, J.M., *Giangarra, C.J., *Major, E.D., *Vance, C.N., & **Shoepe, T.C.** (2012). Reducing error in estimating caloric intake: A comparison of two educational modalities. LMU Undergraduate Research Symposium, poster presentation.

7. *McDonald, K., Grote, S., & **Shoepe, T.C.** (2012). Effect of training mode on post-exercise heart rate recovery of trained cyclists. LMU Undergraduate Research Symposium, oral presentation.

8. Almstedt, H.C., Urbinati, C.R., *Ligouri, G., *Spiegel, M., *Stapleton, M.R., & **Shoepe, T.C.** (2011). 12-weeks of whole body vibration with resistance exercise is osteogenic at the spine. *American College of Sports Medicine Annual Meeting*, poster presentation.

9. *Fenoglio, Z., *Murray, K., **Shoepe, T.C**., & Almstedt, H.C. (2011). Body

composition analysis in Hispanic males. LMU Undergraduate Research Symposium, oral presentation.

10. *Barragan, N., Almstedt, H.C., Ramirez, D.A., & **Shoepe, T.C**. Are college students meeting the dietary reference intakes for nutrients related to bone health?
    a. LMU Undergraduate Research Symposium, poster presentation, (2009).
    b. Southwest American College of Sports Medicine Annual Conference, poster presentation, (2008).

11. *Kohler, D.R., **Shoepe, T.C**., Ramirez, D.A., & Almstedt, H.C. Effects of resistance training using elastic bands in combination with free weights on peak knee extensor torque at various speeds.
    a. LMU Undergraduate Research Symposium, poster presentation, (2009).
    b. Southwest American College of Sports Medicine, poster presentation, (2008).

12. *Canepa, J., **Shoepe, T.C**., Ramirez, D.A., & Almstedt, H.C. Gender differences in bone accrual with high intensity resistance training.
    a. LMU Undergraduate Research Symposium, poster presentation, (2009).
    b. Southwest American College of Sports Medicine, poster presentation, (2008).

13. **Shoepe, T.C.** Ramirez, D.A., & Almstedt, H.C. (2008). Elastic band prediction equations and loading quantification for combined free weight and elastic band bench presses and squats. *National Strength and Conditioning Association Annual Conference*, poster presentation.

14. **Shoepe, T.C**., Stelzer, J.E., Garner, D.P., & Widrick, J.J., (2002). Contractile function of single muscle fibers from chronically resistance-trained humans. *The FASEB Journal,* 16:4, A446.

15. Widrick, J.J., Maddalozzo, G.F., Garner, D.P., Stelzer, J.E., **Shoepe, T.C.,** & Snow, C.M., (2002). Estrogen replacement therapy and contractile function of muscle fibers from early post-menopausal women. *The FASEB Journal,* 16:4, A761.

16. Garner, D. P., Stelzer, J.E., **Shoepe**, **T.C.,** Mull, J., McCubbin, J., & Widrick, J.J., (2001). Cross-bridge mechanisms of muscle weakness in multiple sclerosis. *The FASEB Journal*, 15:5, A814.

Presentations

Oct. 2012	"Engaged technology and experiential learning: iPads, digital microscopy, and Internet freeware in the creation of lab Atlas projects" presented to the Center for Teaching Excellence at Loyola Marymount University.
May 2012	"Measuring learning: Can a novel, experiential class project based on Pink's motivational attributes improve student learning?" presented as a mentored scholar at the annual conference of the International Institute for SoTL Scholars and Mentors.
May 2012	"Engaged technology and experiential learning: iPads, digital microscopy, and Internet freeware in the creation of lab Atlas projects" presented at the annual conference of the Human Anatomy and Physiology Society.
Mar. 2012	"On-line learning: The future?" a panel discussion presented to the Center for Teaching Excellence at Loyola Marymount University.
Mar. 2012	"Teaching with technology: Interaction and perceptions with online instruction" accepted be presented at the 24th Annual Lilly West Conference on College Teaching provided by the International Alliance of Teacher Scholars.
Sept. 2011	"Experiencing virtual classrooms: A Workshop of possibilities" presented to the Center for Teaching Excellence at Loyola Marymount University.
Sept. 2011	"Teaching with technology: Examining what is possible with online instruction" presented to the Center for Teaching Excellence at Loyola Marymount University.
Aug. 2009	"Practical Plyometrics: Implementing the Guidelines of the National Strength and Conditioning Association" presented to the Region I Congress of the United States Association of Gymnastics.
Oct. 2008	"Create. Share, Learn. iTtunes U and Podcasting" presented as part of LMU On Demand through the Center for Teaching Excellence at Loyola Marymount University.
Apr. 2008	"I.N.V.E.S.T. Investigating New Variables in Exercise and Strength Training: Cutting Edge Performance Training" presented to the Science Seminar Series at Loyola Marymount University.
Jan. 2008	"I.N.V.E.S.T in Muscle and Bone Health: Investigating New Variables in Exercise and Strength Training" presented to the Junior Faculty Seminar series of Loyola Marymount University.

May 2007	"Gateway Exams on Blackboard™" presented to the Human Anatomy and Physiology Society Annual Meeting.
Apr. 2007	"Modern Resistance Training: the theory and effectiveness of new techniques" presented to the Far West Athletic Trainer's Association Annul Meeting.
Mar. 2007	"Creating Gateway Exams on Blackboard™" presented to The Center for Teaching Excellence at Loyola Marymount University.
Mar. 2006	Created, compiled, and presented a seminar explaining a yearlong physical training program to the members of the LMU Women's Soccer Club.
Feb. 2005	"Resistance Training – A Miracle Cure?" Presented to the OSU Academy of Lifelong Learning.
2002-2003	Fitness Over 50 – Fitness and Health Evaluation Clinic. Once each academic term I produced a fitness assessment clinic at a local health/wellness facility as a term project for students in the fitness testing class.
Feb. 2003	"Resistance Training for Seniors" Presented to the OSU Academy of Lifelong Learning.
Jan. 2000	"Ergonomic Gardening: Exercises for a Healthy Back and Good Posture" presented to the Benton County Master Gardener Association.

Grants

2011	**Human Anatomy and Physiology Society (HAPS)** Author and PI: Faculty Grant Program ($1500) Project Title: *Student Generated Dissection Images and Mobile Computing in a Human Anatomy Lab*
2011	**LMU Seaver College of Science and Engineering** Author and PI: Course Development Grant ($5000) Project Title: *Creation of a Food Image Database to Promote Portion Size and Caloric Estimations in Online Nutrition Courses*
2011	**LMU Office of Faculty Development, Academic Technology Committee** Author and Co-PI: Academic Technology Grant ($6000) Project Title: *Mobile Technology Integration in General Nutrition Classes*
2010	**Loyola Marymount University, Office of Faculty Support** PI: Rains Research Assistant Funds Program ($1200)

Project Title: *Investigating New Variables in Exercise and Strength Training 2.0*

2009 **Loyola Marymount University, Office of Faculty Support**
PI: Rains Research Assistant Funds Program ($1200)
Project Title: *Investigating New Variables in Exercise and Strength Training 1.0*

2008 **Loyola Marymount University, Office of Faculty Support**
PI: Rains Research Assistant Funds Program ($1200)
Project Title: *Investigating New Variables in Exercise and Strength Training 1.0*

Awards and Recognitions

2012 **International Institute for SoTL Scholars and Mentors - Mentored Scholar**

2011 **Publication of the Year, Journal of Human Kinetics (Shoepe et al., 2011)**

2010 **Associated Students of Loyola Marymount University (ASLMU)**
Finalist for the Seaver College of Science and Engineering Professor of the Year.

2009 **Associated Students of Loyola Marymount University (ASLMU)**
Seaver College of Science and Engineering Professor of the Year

2008 **Associated Students of Loyola Marymount University (ASLMU)**
Finalist for the Seaver College of Science and Engineering Professor of the Year

2006 **Loyola Marymount University Disability Support Services**
Recognition Award for Extraordinary Faculty and Staff

2004 **Oregon State University Services for Students with Disabilities**
Certificate for "collaborations with the offices of SSD in providing accommodations for Oregon State University's students."

2002 **Sixth IOC World congress on Sport Sciences**
Research Poster Award Finalist – Behavioral Section
Title: *Contractility of Single Muscle Fibers from Chronically Resistance Trained Humans*

2001 **Faculty/Staff Fitness Program**

Victor "Vic" Brookes Award for Instructional Excellence

1993 **Eagle Scout**
Boy Scouts of America, Pacific Crest Council, Pioneer District, Troop 229; Portland, OR

Certifications

2012- present **American Red Cross**
Blood and Blood-Borne Pathogens Training

2005-present **American College of Sports Medicine** (ACSM)
Health and Fitness Specialist (HFS)

2000-present **National Strength and Conditioning Association** (NSCA)
Certified Strength and Conditioning Specialist (CSCS)

1995-present **American Red Cross**
Adult CPR

1995-present **American Red Cross**
Standard First Aid

2007 **National Cancer Institute**
Human Participants Protection Education for Research Teams

2003 **Radioisotopes Usage Certification** (Oregon State University) -
Provisional use agreement for working with radioisotopes

2001-2002 **American Red Cross**
Instructor: Standard First Aid/CPR

ABSTRACT

The number of online courses in higher education is on the rise; however, empirical evidence elucidating best practices for synchronous online instruction is needed to implement these courses. The purpose of this dissertation was to perform a mixed-method investigation into the relationships between instructor prompt and student engagement in 5 areas based on the 7 Principles of Good Practices in Undergraduate Education using recorded chat, video, and audio transcripts of two recent fully online nutrition courses. A total of 25 previously recorded synchronous sessions including oral and textual chat interactions were transcribed. Every line of student interaction was determined to be either superficial or containing evidence of at least one instance of engagement. Every line of instructor interaction was concurrently coded for at least one of the following forms of prompt: social, organizational, intellectual. Inter-tester reliability of coded interactions was determined to be excellent (Cohen's kappa = 0.91) on a 5% sample of the entire dataset before comprehensive analysis continued. In total, 172,380 words were exchanged through 13,394 oral and text interactions across all class sessions. With 54% of student interactions deemed superficial the remainder produced a total of 8,906 student engagements. There were 4,125 instructor prompts composed of 48% intellectual, 30% organizational, and 22% social cues. Pearson correlations were performed to investigate relationships between prompt and engagement across class sessions. Intellectual prompts were the best predictor of faculty interactions, active and collaborative learning, and academic challenge (r=0.77, r=0.78, r=0.54 respectively); organizational prompts were the best predictor of enriching academic experiences (r=0.72); and social prompts were the best predictor of supportive campus environments

(r=0.79) with all of these being significant (p<0.01). No category of engagement was significantly correlated to class performance. Online synchronous class sessions can promote high levels of student engagement. A variety of instructor prompts must be used in order to promote student engagement across a number of different categories. Finally, care should be taken in order to craft and facilitate learning activities in synchronous online class sessions in order to achieve desired learning outcomes.

Chapter 1 – Statement of the Problem

Overview

The size and scope of institutionalized post-secondary education is profound and growing. In the fall of 2009, there were an estimated 19 million students enrolled in institutions of higher learning in the United States (Allen & Seaman, 2010) with annual enrollment increases varying between 1-3% over the last decade. Thus, providing quality and effective education in a rapidly changing time of unprecedented technological advancement, evolving workforces, and a worldwide recession is crucial. One of the most utilized guiding philosophies over the past 25 years has been the Seven Principles for Good Practices in Undergraduate Education first characterized by Chickering, Gamson, Poulsen, and Foundation (1987). In brief, these guidelines sought to standardize a set of recommendations to review, evolve, and create educational programs into the future. At the core of the Seven Principles, is a belief that successful undergraduate education (a) encourages contact between students and faculty, (b) develops reciprocity and cooperation among students, (c) encourages active learning, (d) gives prompt feedback, (e) emphasizes time on task, (f) communicates high expectations, and (g) respects diverse talents and ways of learning (Chickering & Gamson, 1999; Chickering, et al., 1987). Since then, with scholarly citations in excess of 2000 as of this draft, the Seven Principles have been one of the most referenced frameworks in the academic literature working to characterize and shape higher education.

The increasing interconnectedness of the world suggests that online education is here to stay and furthermore, for the foreseeable future, online education will continue to expand across all educational sectors. In the last 10 years alone, student enrollment in

online courses has risen from 1.6 to 5.6 million, representing a jump from 9.6% of students taking at least one online course to more than 29% of post-secondary students taking at least one class entirely online (Allen & Seaman, 2010). Between the fall of 2008 and 2009, online enrollments across the nation experienced a growth rate of over 21%. The past trends are remarkable but the future prognostications suggest that this trend will not soon be reversed. As of 2010, the percentage of institutional CEOs agreeing that online education was critical to the long-term success of their institutions was at a decade long high of 63% compared to a decade long low of 12% of respondents who disagreed (Allen & Seaman, 2010). Distance education has shifted tremendously in the past decade with the now ubiquitous access to the Internet as well as recent advances in communicative technologies that do much to span the divide of geographic space. Where online education was once viewed as an inferior form of education, the tide has shifted so that when delivered well, online education has gained widespread acceptance. Evidence to this is reported by Allen and Seaman (2010) where the institutionalized perception of online education has been changing in the last 10 years such that university Chief Academic Officers (CAOs) are increasingly stating their perception at ever higher rates that online education is equivalent to, if not superior to traditional face-to-face (F2F) instruction. Moreover, the recent Educause Center for Applied Research report recommended that university researchers further investigate their students' technological uses and preferences to better integrate these technologies into blended, or hybrid, courses (Dahlstrom, Grunwald, Boor, & Vockley, 2011). As with all approaches to pedagogy, it is a necessity to investigate the effectiveness of current practices in efforts to better our ability to educate societies. Insomuch as online education is increasing and the

facilitative tools are evolving at rapid paces, it is even more imperative that studies be done to develop a deeper understanding of the positives and negatives of online learning formats.

Of utmost relevance to this proposal, is the rapidly evolving set of digital, Internet-supported tools available to online educators. Methods of interaction in all education can be classified as either synchronous or asynchronous. Asynchronous modes of delivery are characterized by a "transmission and receipt of information [that] do[es] not occur simultaneously" (Ruiz, Mintzer, & Leipzig, 2006, p. 208) and examples include "e-mail, online bulletin boards, listserves, newsgroups, and Weblogs" (Ruiz, et al., 2006, p. 208). In contrast, synchronous modes of interaction occur at the same absolute time where students and faculty are communicating in real-time "synchrony" with one another. Examples of synchronous instruction include audio and video teleconferencing, virtual classrooms, and instant messaging (Ruiz, et al., 2006). While asynchronous methods have been the dominant form of instruction since the inception of distance formats, Internet-supported technologies and improved access to computers and the Internet have made a number of new and varied forms of synchronous tools available to educators. Surprisingly, despite an explosion of new instructional techniques coupled with the exponential increase in online enrollments and courses; there is a surprising scarcity of research examining the pedagogical efficacy of these methods. As stated, by Shi, Bonk, Tan, and Mishra (2008), the rampant growth of these tools and online learning in general has "far outpaced our understanding and knowledge of it" (p. 3). Most importantly, the pros and cons of real-time virtual classrooms (e.g. Webex, Eluminate, Adobe Connect, Blackboard Collaborate, etc.) that support group audio and video

teleconferencing, chat, and whiteboard tools simultaneously have yet to be clearly established. Some explorations have been conducted into (Batts, 2008; Batts, Colaric, & McFadden, 2006; Tirrell & Quick, 2012) the degree to which the Seven Principles have been included in online courses. However, the authors also suggested that some areas of engagement were low with online courses through student and faculty surveys. To my knowledge, there has yet to be a non-survey based investigation into student engagement in online courses.

Statement of the Problem

Online education is likely to become an ever more present aspect of higher educational practice into the future. In a recent meta-analysis of online education, Bernard et al. (2009) concluded the matter of comparing online to F2F education a practice "whose time has passed" (p. 1267) and suggested rather that efficacy studies in the field now focus on the specific instructional interventions that are associated with online education. The Seven Principles for Good Practice in Undergraduate Education provide a useful framework in investigating the level of student engagement in learning in F2F educational format and while some studies have begun to elucidate engagement in online education, more work is necessary. In particular, the Seven Principles as applied to modern synchronous forms of instruction has yet to be clearly characterized. If the rates of online enrollment are to continue to increase at present rates and the instructional methodologies continue to be poorly understood, educational objectives will likely suffer. An original investigation resulting in a full description of student engagement during synchronous online instruction within a framework of the Seven Principles would help

future online educators in the design and delivery of their instruction by describing the relationship between instructor action and student engagement.

Purpose

The purpose of this dissertation was to perform a mixed-method investigation into student engagement in five areas based on the Seven Principles using recorded chat, video, and audio transcripts of two recent fully online nutrition courses. Characterization of transcript evidence of student engagement was further compared to the various categories of facilitator action in order to prepare a list of instructor prompts and behaviors that would be associated with each category of engagement. Additional analysis of student surveys and open-form written interviews triangulated the relationship between instructor action and resulting student engagement in synchronous online course tools. The results of this investigation provide descriptive analysis of synchronous class sessions in order to help shape the best instructor practices in synchronous instruction.

Research Questions

1. What are the frequencies and types of student engagement in online synchronous chat transcripts?
2. What are the frequencies and types of instructor prompt in online synchronous chat transcripts?
3. What is the relationship between instructor prompt and student engagement in online synchronous chat transcripts?

4. What is the relationship between student engagement in both final exam and overall class performance?
5. What is the relationship between instructor prompt and student engagement according to student perception?

Conceptual Framework

One set of aspirational guidelines is the Seven Principles for Good Practice in Undergraduate Education which a) encourages contact between students and faculty, b) develops reciprocity and cooperation among students, c) encourages active learning, d) gives prompt feedback, e) emphasizes time on task, f) communicates high expectations, and g) respects diverse talents and ways of learning (Chickering & Gamson, 1999; Chickering, et al., 1987). The National Survey of Student Engagement (NSSE) has since the first major launch in 2000 assessed student engagement across all of higher education based on the model of the Seven Principles (National Survey for Student Engagement, 2000, 2011). Suggesting some level of overlap among the Seven Principles, the NSSE collapsed the original seven into five areas or *benchmarks* of successful educational practice resulting in the following areas: a) level of academic challenge, b) active and collaborative learning, c) student interaction with faculty members, d) enriching educational experiences, and e) supportive campus environments (Kuh, 2001). The role of the instructor is key in creating an environment that promotes student engagement. By facilitating discussion, guiding students from one discussion to the next, or providing feedback, the instructor's specific acts were investigated as to what type of actions take by the instructor led to a specific type of student engagement. Instructor prompt behavior

for this proposal was categorized according to the work of Burnett (2003) resulting in the classification of three areas of instructor prompts: (a) social, (b) organizational, (c) and intellectual.

Summary of Methodology

Classroom transcripts and student class evaluation questionnaires from two online summer nutrition courses were assessed for evidence of engagement according to a modified standard of the Seven Principles as described previously (Chen, Lambert, & Guidry, 2010; Kuh, 2001). This modified grouping of the original seven categories resulted in the evaluation of five major areas of interest according to the work of (Kuh, 2001). Because of the extensive literature and widespread use of the NSSE, this investigation used codes adapted from the NSSE questionnaires as criteria for measuring student engagement through evaluation of synchronous class transcripts.

The most important analysis resulted from a careful reading of each live synchronous class transcript. Every student post that was deemed to be not superficial in nature was coded according to the type of engagement displayed and which category of instructor action preceded it. The primary author and a trained research assistant confirmed inter-tester reliability across categories of codes (e.g. engagement, instructor prompt, type of interaction) prior to the comprehensive coding by the research assistant. A cross-tabulation chart was produced from the accumulated coding and a Chi-Square analysis gave insight as to the most common instructor behaviors and the most common types of engagement. The online transcripts were also examined for the general flow of information by quantifying the frequency of chat posts during synchronous online

sessions. These were examined further to determine the rate of chat during varying times of the class session and statistical analysis examined potential differences in chat flow over time. Concluding analysis determined whether there are differences in chat rate during audio or video presentation segments.

Significance

Online education is here to stay (Glenn & D'Agostino, 2008; Parsad, Lewis, & Tice, 2008; Smith, Salaway, & Caruso, 2009; Tallent-Runnels, Thomas, Lan, Cooper, Ahern, Shaw, & Liu, 2006). Moreover, online education is likely to be an increasingly more common and frequently utilized educational method into the distant future. It is imperative that we adequately characterize the efficacy of tools available to online educators in order to promote the adoption of tools to match the learning objectives for each course. This project sets out to describe the degree to which synchronous online nutrition class sessions facilitate student engagement and which instructor actions play a role in predicting or promoting student engagement.

Limitations

This study took place in the examination of a small sample of students enrolled in a first-time offering online nutrition course taken as a general education (core) class at a private, religiously affiliated university. This sampling is likely to limit the generalizability of the study findings to dissimilar classes, students, or institutions. The questionnaires were distributed through the Blackboard survey tool, which produces anonymous results and therefore prohibited the comparison of individual questionnaire

data to student performance and synchronous engagement. This is because Blackboard registers completed surveys, but does not link the data to any identifiers during data download. Completion of the questionnaires was mandated for class participation and it is possible that students were unaware of the anonymity of their responses, which might have introduced bias into the responses in efforts to positively influence the instructor's perception or mitigate the negative perception that might results from honest comments and criticism.

Definition of Terms

1. Asynchronous - A form of instruction where students and/or instructors are interacting at different times.
2. Blended – Courses that are delivered with a combination of online and traditional, face to face components (Tallent-Runnels, et al., 2006)
3. Distance education – Instruction where the students and professor are not all in the same physical space (Tallent-Runnels, et al., 2006)
4. Hybrid – An accepted synonym for blended learning (i.e. courses that are delivered with a combination of online and traditional, face to face components (Tallent-Runnels, et al., 2006)
5. Online - Courses that are delivered solely via the Internet (Tallent-Runnels, et al., 2006).
6. Synchronous – A real-time form of instruction where students and/or instructors are online and interacting at the same time.

7. Videoconferencing – a form of synchronous instruction that utilizes single location facilities set-up with given technologies where individuals or groups of individuals could meet and communicate in realtime with another facility. This is similar to webconferencing but different in that this requires people to go to a specific location for meetings instead of simply being connected to the Internet (Valaitis, Akhtar-Danesh, Eva, Levinson, & Wainman, 2007).
8. Webconferencing – a form of synchronous instruction that utilizes Voice-over Internet protocols for communication between a network of computers. This is similar to videoconferencing but different in that this allows for individuals to meet through the use of the personal computers instead of at a facility that would be adequately equipped (Valaitis, et al., 2007).

Summary

Online education is a phenomenon becoming more entrenched in the accepted practice of higher education. The explication of online instruction is necessary at this time to provide the understanding and framework by which this form of instruction will evolve in the generations to come. A major aspect of online instruction is class delivered in real-time synchrony and it is the intention of this dissertation to explain how student engagement can be promoted with synchronous activities. Furthermore, the role of the instructor as a moderator in synchronous events was examined in order to provide recommendations to future online instructors looking to improve student engagement. The remaining sections will include a review of online literature in the context of classic educational theory. This will be followed by a description of the study methodology and procedures that were completed, the results and analysis stemming from this study, by a

discussion on the contributions to the existing literature on these topics, and concluding remarks.

Chapter 2 – Review of the Literature

Introduction

The following review of literature will cover the current state of online education including the growth and rationale for the current expansion of this form of course delivery. Engagement, considered the time that students spend with that which is to be learned, will then be discussed in order to better understand the types of engagement and how engagement is interpreted in the context of learning theory. Embedded within a discussion of engagement will be the role that the instructor as a moderator in synchronous online class sessions will be addressed as it pertains to a form of engagement known as student-faculty interactions. At the conclusion of this section, the reader will be made aware that engagement has been described at length in F2F classes and in retrospective, survey form for online class deliveries. However, this dissertation serves to fill a current gap in the existing literature where direct evidence has yet to be provided as to the role that synchronous classes play in promoting student engagement. A major purpose of this dissertation is to contribute to the descriptive work of Burnett (2003) who categorized the types of actions of instructors in synchronous sessions by tying the actions of the instructor to the likely student engagement that might result.

Development of Online Education

Recently, one of the major strategic items of administrators at institutes of higher education has been the expansion of online supportive educational programs including distance education. In the last couple of years, online education enrollments have

experienced growth rates in excess of 21%, vastly outpacing the 2% growth rates of higher education *in toto* (Allen & Seaman, 2010). While the factors contributing to this are numerous (Dykman & Davis, 2008), the rise in online education over the past generation is likely to continue into the foreseeable future (Dykman & Davis, 2008; Mayadas, Bourne, & Bacsich, 2009; Smith, et al., 2009). For example, a recent sample of over 2500 institutions of higher education suggested over three-quarters of surveyed administrators reported the economic downturn has played a role in increasing demand for online courses and 63% of administrators believed online learning was a critical part of the future of their institution (Allen & Seaman, 2010). Interestingly, recent data does support disconnects between faculty and administrator attitudes regarding online instruction. For example, optimism for a strategic shift to online education is not as widely received across campus where 80% of administrators compared to 58% of faculty said that they had "more excitement than fear" (Allen, Seaman, Lederman, & Jaschik, 2012, p. 2) for the growth of online education. Accordingly, the authors reported differences in perception and motivation behind the expansion of online offerings where 21% of administrators compared to 8% of faculty felt that "my institution is pushing too much online instruction" (Allen, et al., 2012, p. 2). Another interesting finding was the difference in perception for whether online education can be as effective as F2F in helping student learning. Here, 38% of faculty agreed that online education can be as effective as F2F education (compared to 47% disagree) whereas administrators agreed 83% (compared to 11% disagree) that online can be as effective as F2F (Allen, et al., 2012). The underlying basis for this might be twofold. First, administrators might demonstrate a broader and more comprehensive set of experiences which guides

confidence in online effectiveness or they might just be sufficiently far removed from these technologies in their own experience to make them sufficiently naïve and hopeful. Overall, despite intra-institutional job differences in the online movement, we are currently enmeshed in an expansion of online higher education programs and this area will see continued growth for at least the decade to come (Allen & Seaman, 2010). In order to further understand online movement as a whole, it is altogether necessary to provide a discussion of the motivations and justifications used to advocate on behalf of online education that follows in the ensuing section.

Economics. Among the many reasons cited for the increase in online programs is simply a matter of economics. Worldwide recessions and high rates of unemployment in the last three years have brought scrutiny and a number of challenges to many industries and institutions trying to succeed in a challenged global economic time (Baum & Ma, 2011). During this era where decreased publicly subsidized revenue and increased expenditures have become the norm, higher education as an institution has been assailed for its high costs (Bernstein, 2011; Bowen, 2012) and thus has not avoided the scrutiny of potential belt tightening (Allen & Seaman, 2010; Baum & Ma, 2011). Two of the more marked criticisms raised in the public sphere in recent years have been the result of both rising educational expenses and expanding student debt (Archibald & Feldman, 2010; Bowen, 2012). This criticism has been more profound in the past couple of years perhaps in part because there has been a decrease in the mean family income while tuition rates have seen consistent increases (Baum & Payea, 2011). Over the past 30 years, while overall rates of inflation during this time averaged 3.2%, the combined cost of public and private four-year institutions has risen over 7% (Archibald & Feldman, 2010).

California alone in 2010 has seen increases totaling over 20% compared to national increases of 8.3% in public institutions of higher education (Baum & Ma, 2011). From another source, it has been reported that between 1986 and 2011, tuition rates have increased at 2.5 times (+498%) the rate of overall inflation (+114%) during this time (Wadsworth, 2012). Families seeking cheaper higher educational opportunities such as public universities and community colleges are seeing diminished prospects due to state and federal budgetary woes that have caused cuts in faculty, classes, and programs (Straehley, 2011). While the reasons given for cost hikes include expanded investment in scholarships, expanding programs, and infrastructure, the bottom line is that the expense of a formal education is becoming more and more exaggerated (Baum & Ma, 2011). Though both public and private institutions have been spending money at increasing levels, public institutions have further encountered decreased state and federal funds due to reduced tax revenues while both types of institutions are seeing other revenue challenges through decreased donations and more competition for research grants compounded by cut-backs in federal funding budgets (Baum & Ma, 2011). One way to account for attempts to close the budget gap is through tuition revenue where, even before the economic woes of the past four years, tuition rates have been outpacing overall inflation for at least the last 30 years. Tuition therefore has been a valuable source of additional revenue where of course, the institutional cost is at least in part passed on to students (and their families) where as a result, the combined student loan debt in American will exceed $1 trillion by the end of 2012 (Selingo, 2012). Spread out per student, the average college senior graduating this year will participate in commencement ceremonies with personal responsibilities to creditors of $25,000 (Baum

& Payea, 2011). One example why this is of concern is the disproportionate effect debt has on decreasing graduate school matriculations of ethnic minority students (Malcom & Dowd, 2012) and thus expanding educational gaps amongst ethnic groups. In at least one major area, this is a relevant societal concern for Science, Technology, Engineering, Mathematics (STEM) fields where shortfalls are forecast in already overextended workforces in public health (Perlino, 2006), medicine (Association of American Colleges, 2006; Salsberg & Grover, 2006), nursing (Buerhaus, Donelan, Ulrich, Norman, & Dittus, 2006), physical therapy (Salsberg & Grover, 2006), and physician assistant (Larson & Hart, 2007). Shortfalls are forecast to worsen because of an expanding demand on our healthcare system due to an aging citizenry that is compounded by decreases in the overall application pool attributed to declining non-white application rates (Syed & Chemers, 2011) without concomitant correctional increase in non-minority applicants.

One major strategic initiative in trying to improve budgetary situations is movement towards online education (Bowen, 2012; Dykman & Davis, 2008). This is because online education displays potential for creating, delivering, and maintaining instructional content in a more cost-efficient manner. Where the purpose of F2F traditionally has meant lecture time for the purpose of content delivery, there are a number of new possibilities that decrease the necessity of instructor-centric delivery including lecture capture (Dykman & Davis, 2008; Greenberg & Nilssen, 2009; Owston, Lupshenyuk, & Wideman, 2011). Exemplar universities including Harvard, MIT, Princeton, Stanford, and the University of Pennsylvania have moved entire class curricula to free access-Internet databases available to the world at any time (Duncan, 2012;

Matkin, 2012; Salinero & Beardsley, 2009). Some have even begun to question the long-term future of higher education with the litany and quality of free online information available including the new Khan Academy that is now serving millions around the globe (Thompson & Carpenter, 2011, July). Some authors have suggested that another mark of our age has been an unfortunate shift away from apprentice-style transfers of knowledge and experience and that technology perhaps might be able to reverse this trend (Wenger, White, & Smith, 2009). Nonetheless, online resources can lessen the need for professors to be present during shared class time when content is necessarily covered, because an ever-increasing volume of pre-recorded material from the world's elite are now at the disposal of the students at all times (Dykman & Davis, 2008; Greenberg & Nilssen, 2009). Moving from "sage on the stage" (Baker, 2000, p. 9) model to a "guide at the side" (Baker, 2000, p. 9) frees up time spent with instructors to be dedicated to specific scaffolding exercises, trouble-shooting, and problem solving activities and perhaps decreasing the need for faculty contact time for his purpose altogether (Baker, 2000). When content needs to be delivered by the specific instructor, modern computer technologies have made easier the recording and distribution of material in a cost efficient, simple, and professional manner in what has become known as the *flipped* class (Baker, 2000; Greenberg & Nilssen, 2009; Lage, Platt, & Treglia, 2000; Owston, et al., 2011). A further major advantage is that a recording of lectures or tutorials can be more easily passed between participants on a recurrent basis. This frees up additional time for instructors to dedicate to other pursuits such as supporting and advising additional students (Greenberg & Nilssen, 2009; Owston, et al., 2011). While there are numerous costs associated the initiation and maintenance of purely online delivery such as technical

support, video-editing, server logistics, and start-up procedures, the recycling of instruction might provide long-term economic benefit (Glenn & D'Agostino, 2008; Mayadas, et al., 2009).

A hot-button topic for most educators is the relationship between class size and performance. In a study by Monks and Schmidt (2011), there were two significant findings including a negative correlation between student performance and class size. The authors suggested that negative correlations might not be due entirely to the size of the class directly but also due to the logistical and pedagogical changes that instructors might implement with increasing class sizes. Despite not receiving blanket acceptance amongst educators, there is potential for online education to allow for instructors to support more students simultaneously without sacrificing learning (Finkelstein, 2000; Glenn & D'Agostino, 2008). This would further promote long-standing supposition that instructors and thus instruction *should* move from a model of teacher to mentor (Dewey, 1916; Glenn & D'Agostino, 2008) which would afford more time for scaffolding, feedback, and modeling instead of content delivery (Dahlstrom, et al., 2011). Another area of interest is the Massive Open Online Course (MOOC) that supports potentially infinite numbers of students in a collaborative learning community supported entirely through online tools (Mackness, Mak, & Williams, 2010). The conclusion here is that reconfiguring the student-professor relationship might produce enhanced learning for the student while allowing professors the ability to support more students and thus improve financial burdens induced by current class size models.

While the major expenses for college and university annual operating budgets is the administrative and instructional labor force, which could be reduced through a

conversion to online formats only, additional money can be saved in decreasing expenses related to infrastructure creation and support. Harvard University as one example, as part of its 2009 fiscal operating expenses dedicated 26% of its $3.8 billion annual budget to space and occupancy, depreciation, and supplies and expenses- all areas of potential cost reduction in an online format representing a pool of almost $1 billion in potential savings (Harvard University, 2009). More specifically, $644 million of this was invested in new construction, acquisitions, and updates to the physical plant, all factors that are of decreasing necessity with campus infrastructure reductions occurring with conversion to online formats. Not to be seen as an isolated outlier in the incessant, mandated donation and revenue generating giants that are higher education today, a 10 year fundraising program for UCLA generated $634 million for new and enhanced facilities alone (University of California: Los Angeles, 2009). These monies dedicated to the non-annual, overall development of UCLA are further compounded by the potential infrastructure and facilities support that are seen with 20% of their $18.1 billion annual operating budget dedicated to equipment, supplies, and utilities which represents an area of potential savings representing $3.62 billion alone. First, with a vastly reduced need for physical classrooms and laboratory spaces, the cost of maintaining and erecting buildings is potentially dramatic. This could promote savings immediately in terms of maintenance fees, but also long term in fundraising and construction costs. This in turn might lead to an overall decrease in campus size, fewer buildings, parking structures, road maintenance, and one of the largest contributors to campus maintenance – the facilities support staff. With a smaller student per campus number and corollary reduction in the support staff, savings could occur not only in physical materials but also in human

capital, salary, and benefits packages. An additional category of cost savings could be seen through reduced expenses in student affairs – programs including recreation services, clubs, student groups, health services, and one of the fastest growing areas of expense, liability insurance policies for students and visitors to campus.

These potential cost savings to higher education are indeed real and could provide an incredible change in the size and value associated with education in the United States today. In California alone, budgetary shortfalls are likely to produce statewide reductions in community college classes on the order of 20% in the next year (Straehley, 2011). This would reduce the number of students in the California community college system by an order of 400,000 by some estimates (Straehley, 2011). Those who are able to maintain enrollment could see increases tuition of more than 150%. This devastating reduction in the numbers of available classes, decreasing enrollments, and increasing cost of education is exponentially troublesome when one considers the expected some workforce deficient fields like medicine and health care workers forecasted to intensify over the next 20 years. Perhaps even more concerning is the decreased talent pool that will be applying to the post-graduate programs that might be forced to lower their admission standards in an effort to meet the numeric shortfall.

Social Justice. Advocates for the expansion of online education go much further that budgets and economics in support of the efficacy of this instructional format. In fact, there are a number of factors unique and advantageous to online education that supports a broader adoption in higher education. Thomas Jefferson, among many of the founders, believed in freedom of educational opportunity for all of the citizenry (Conant, 1962) that has since permeated the American ideal. In premise, the opportunity to engage in

academic endeavors throughout the lifespan is an implicit right of Americans. However, during the early days of the nation, one could hardly imagine the technological transformation that would befall all of society in the speed, density, and accessibility that has come forth from the Internet age. One of the powerful strengths of online education is an evermore-ubiquitous nature of technology (Dahlstrom, et al., 2011) that does more to support an inclusive environment than what would be possible in F2F (Dykman & Davis, 2008; Matkin, 2012). By breaking down the necessity of proximity to college campuses and classrooms through online classes, a broader student base can be reached (Dykman & Davis, 2008). Low-income students can now be reached at home without undue additional living expenses. Fulltime workers can remain committed to continuing education or retraining for different careers without having to change jobs, stop working or relocate closer to campuses that offer the finite programs in which they are interested (Mayadas, et al., 2009). Students with physical or mental disabilities have more learning accessibility where they can remain closer to caretakers and supportive environments while being full engaged in learning activities. Online courses simply broaden the potential to reach a much more diverse student group and additionally provide the reciprocal advantage to the learner who will be afforded a diverse exposure to students who are either unable or who would normally not attend a traditional F2F class (Dykman & Davis, 2008; Means, Toyama, Murphy, Bakia, & Jones, 2009). All of the evidence is not however supportive of closing the socioeconomic and ethnic gaps that exist in educational achievement. An example of this was a lower effect size in favor of online instruction found in ethnic minorities, males, and low achieving students (Figlio, Rush, & Yin, 2010). Nonetheless, as described, online education provides prospects for progress

in social justice that has been purported to have potential in equaling the current disparities in education access and opportunity at present. Furthermore, the potential for a more inclusive environment in online classes might produce collateral advantage to more traditional learners in terms of diversity exposure and potentially transformative experiences that might otherwise not have been provided.

Effectiveness. With the previous list of factors in favor of online instruction, a legitimate question then arises about comparative effectiveness. Until recently, while it was unclear whether online education could compete with F2F methods in terms of promoting learning, the debate seems to be concluding. In pursuit of the answer as to whether or not online education is effective, two separate questions arise. The first is a matter of comparison between F2F methods derived from centuries old traditional methods versus online supported instruction. Advocacy on the part of online education would be supported if empirical findings would suggest an online equivalence or advantage over F2F. Second, as a matter of ethics, one argument for the mission of higher education should be to prepare its alums for the future life into which they will matriculate. Preparation in this form would include the personal and professional competencies necessary to be a successful, contributing member of society. Therefore, a different selling point for online education would be to match current Internet Age *instruction* to the Internet Age in which we *live*. The recent Educause Center for Applied Research (ECAR) (Dahlstrom, et al., 2011) showed us that undergraduate students now represent a generation of learners that have had Internet and digital technologies available to them their entire lives. The national ECAR survey found from over 3,000 students from 1,000 universities and colleges that 87% of students now own a laptop, 67% have

Wi-Fi access, and 55% own smart phones (Dahlstrom, et al., 2011). One of the more remarkable comparisons from this most recent ECAR surveys showed the effect of increasing availability of smart mobile devices where over just two years, the numbers of students using the Internet over the cell phones went from 33% to 55% (Dahlstrom, et al., 2011; Smith, et al., 2009). President Obama (2011) recently capitalized on the transformational opportunities before us in advancing the Internet Age by suggesting in his 2011 State of the Union Address that in the coming years "we'll invest in…information technology…an investment that will strengthen our security, protect our planet, and create countless new jobs for our people" (para. 26). With further specifics ahead, he continued:

> Within the next five years, we will make it possible for business to deploy the next generation of high-speed wireless coverage to 98% of all Americans. This isn't just about a faster Internet and fewer dropped calls. It's about connecting every part of America to the digital age. It's about a rural community in Iowa or Alabama where farmers and small business owners will be able to sell their products all over the world. It's about a firefighter who can download the design of a burning building onto a handheld device; a student who can take classes with a digital textbook; or a patient who can have face-to-face video chats with her doctor" (Obama, 2011, para. 52).

Politicians and policy makers are now onboard and it seems as though we are irreversibly intertwined into an increasingly technological world where to some extent, mobile computing devices, worldwide instantaneous communication, and knowledge commons are likely to be a part of human experiences into the foreseeable future. In concluding

recommendations from the recent ECAR (Dahlstrom, et al., 2011) the authors stated that we should "use technology in more transformative ways such as participatory and collaborative interactions and for higher-level teaching and learning that is engaging and relevant to students' lives and future plans" (p. 52) in order to "extend technology beyond the classroom" (p. 52). The adoption and integration of all forms of technology and online distance education into formal learning institutions is justified in moving students to future communities of professional practice where their future responsibilities might require integration of these technologies (Lave & Wenger, 1991). Examples of this are rampant in the professional world but as an example in just the health sciences, students become more prepared for medical professions because of the expanding use of online supported mobile applications for medical (Cook, Garside, Levinson, Dupras, & Montori, 2010; Cook, Levinson, Garside, Dupras, Erwin, & Montori, 2008; Lustria, Cortese, Noar, & Glueckauf, 2009; Wolbrink & Burns, 2011) and veterinary training (Ellis, Marcus, & Taylor, 2005), heart attack awareness (Leijdekkers & Gay, 2008) dietary assessment (Boushey, Kerr, Wright, Lutes, Ebert, & Delp, 2009) smoking cessation (Obermayer, Riley, Asif, & Jean-Mary, 2004), diabetes treatment (Frost & Smith, 2003), asthma management (Ryan, Cobern, Wheeler, Price, & Tarassenko, 2005), and medical imaging (Eze, Lo, Bray, & Toma, 2005; Tang, Law, Lee, & Chan, 2004). Using technologies in higher education that will be used in post-graduation endeavors represents exactly contextualized, experiential learning that was important to learning theorists (Bruner, 1966; Dewey, 1938; Vygotsky, 1978) and is justified in terms of our future approach to education.

As to the question of data, an early meta-analysis of online versus F2F methods found that educational research is often lacking in external validity, which makes comparisons difficult (Bernard, Abrami, Lou, Borokhovski, Wade, Wozney, Wallet, Fiset, & Huang, 2004). Despite wide ranging findings, for online methods, the authors concluded "in an overall sense, that classroom instruction and [online] are comparable" (p. 416). They further provided evidence for the common-sense belief that effectiveness is not a matter of F2F versus online *per se*, but rather a "provision of pedagogical excellence" (p. 413). This was further supported through a meta-analysis from the U.S. Department of Education in relation to K-12 levels (Means, et al., 2009). Increasingly, while differences have been identified in type of online pedagogy (synchronous vs. asynchronous), evidence mounts to support that when done correctly online education in total can produce equitable results to F2F across a variety of performance measures. This has been reproduced in a number of meta-analyses and perceptual surveys across ages and disciplines (Allen & Seaman, 2009; Bernard, et al., 2009; Bernard, et al., 2004; Means, et al., 2009; Tallent-Runnels, et al., 2006). More recently, some have suggested that the metaphorical book be closed on the effectiveness comparisons between F2F and online education because the two phenomena are both independently well established and justified (Bernard, et al., 2009). The effort moving forward in terms of scholarship therefore should now be in terms of further identifying the practices used in online education and promoting a greater understanding of the improvement of these existing techniques (Bernard, et al., 2009).

Synchronous and Asynchronous. Online education consists of varying levels of integration of both synchronous and asynchronous tools (Johnson, 2006; Mayadas, et al.,

2009). Asynchronous arose from mail based correspondence courses and was subject to the limitations of time constraints and in fact "truly asynchronous because of postal delays" (Bernard, et al., 2004). While each has inherent positive and negative aspects, they nonetheless support student engagement with class content and materials (Repman, Zinskie, & Carlson, 2005). While asynchronous tools are those that occur at different absolute times for the participants, synchronous tools are those that occur in a form of realtime interaction in both of student-student or student-faculty communication. To clarify future use of terminology, *relative time* will refer to the time of day with reference to the time zone one occupies and *absolute time* will refer to a time with indifference to the time zone one is in. As a matter of example, a class meeting at the *absolute* time of 8 am PST would mean students are attending class at different *relative* times around the globe.

Asynchronous have as their most obvious benefit, a tremendous flexibility of scheduling where learning activities and experiences are had at the time-discretion of the participants (Mayadas, et al., 2009). For membership separated by geographic expanse or diverse time schedules, this can be a strong advantage that promotes a broader and more diverse audience of participation. Examples of asynchronous tools include: email, homework, blogs, collaborative web commons (wikis), listservs, and discussion boards. One of the more important strengths of asynchronous learning is that they might increase cognitive level by "encouraging in-depth, more thoughtful discussion; communicating with temporally diverse students; holding ongoing discussions where archiving is required; and allowing all students to respond to a topic" (Branon & Essex, 2001, p. 36). While asynchronous potentially promotes higher levels of Bloom's taxonomy, some

suggest that asynchronous requires more time and provides less social interaction than synchronous chat (Johnson, 2006). Also, asynchronous communication poses issues with immediate feedback, inconsistent student participation timing, discussions that are less intertwined, take more time, and students report feeling isolated and not part of a learning community (Branon & Essex, 2001).

Synchronous would be compared to faculty office appointments or classroom environments from F2F education models where an inquiry of statement could be acted upon or responded to immediately and directly (Ingram, Hathorn, & Evans, 2000). By occurring at the same absolute time, there is a level of immediacy present which could be useful in curtailing deficient or incorrect thought, reprimanding derelict behavior, or preventing student energies lost down unfruitful paths. In comparison to asynchronous, synchronous communication, even though it is often mediated through text-only formats, much more closely approximates spoken F2F communication and thus is suggested to be "more engaging, animating and hopefully enjoyable" (Mcalister, Ravenscroft, & Scanlon, 2004, p. 195). There is also a convenience of form here in kinesthetic skill development through modeling seen in realtime and real, 3-dimensional space. Virtual 3-D spaces (e.g. Second Life) that mimic authentic learning environments where have developed rapidly in the past decade and are suggested to be useful in developing spatial skills that are becoming evermore similar to F2F environments (French, Ransom, & Bett, 1999; Garg, Norman, Spero, & Maheshwari, 1999; Ingram, et al., 2000; Stuckey-Mickell & Stuckey-Danner, 2007; Walker, Kraszpulska, Allen, & Gomes, 2006, November; Wang & Newlin, 2001). These potential benefits in synchronous tools are likely mediated through the more transparent and likely *natural* or culturally spawned communication

method supported through physical proximity where body language can also be modeled as well as promoted in both the conscious and subconscious.

In an online format by intentional necessity, the participants do not occupy the same physical space. This means that all interpersonal interactions are supported through technological means and with that comes a list of limitations. Examples of synchronous instructional tools include chat, instant messaging, audio conferencing, and video conferencing. To support these, for example, synchronous technological tools are often more difficult to set up and administer in terms of cost, logistics, and scheduling. Vast increases in the quality and functionality of online synchronous tools are becoming simplified and less cost-prohibitive (Ingram, et al., 2000). Initial costs occur due to equipment, software acquisition and periodic upgrades, and technological support and training when applicable. Logistics such as technological incompatibility and expertise on either the student or faculty member create physical difficulties and because the communication must occur in realtime, all participants in the interaction must be available at the same absolute time independent of their location on the globe.

Engagement

Synchronous and asynchronous online methods are only means to get at the larger intention of instruction – engagement. And, while no clear consensus exists for the definition of engagement (Salinero & Beardsley, 2009), agreement is seen in that engagement, whatever that might encompass, is critical and positively related to learning. The definition put forth by Kuh (2003) is useful in its remarkably simplicity which in essence refers to the *total time that students spend with course material*. In 1999, a broad

scale effort was initiated in order to quantify the degree- or not to which undergraduate institutions were promoting and achieving student engagement. The resulting National Survey of Student Engagement summarized 63,000 student surveys representing 276 colleges and universities in the United States (National Survey for Student Engagement, 2000). In building the survey, an effort to categorize higher education engagement, the NSSE utilized the original Seven Principles for Good Practice in Undergraduate Education (Chickering & Gamson, 1999; Chickering, et al., 1987). The Seven Principles, as the backbone for the NSSE, evolved to work interchangeably with the concept of engagement and includes the degree to which an institution (a) encourages contact between students and faculty, (b) develops reciprocity and cooperation among students, (c) encourages active learning, (d) gives prompt feedback, (e) emphasizes time on task, (f) communicates high expectations, and (g) respects diverse talents and ways of learning (Chickering & Gamson, 1999; Chickering, et al., 1987). Each of these seven represents a desired objective of institutional education although in the development of the NSSE, the original were seven were consolidated into five areas of engagement demarcation which are: (a) level of academic challenge, (b) active and collaborative learning, (c) student interaction with faculty members, (d) enriching educational experiences, and (e) supportive campus environments (National Survey for Student Engagement, 2011). These principles and thus engagement (as we will continue to refer to it heretofore), have their foundations firmly entrenched in a century of educational theory. It is apparent upon close inspection of these principles that they can be adequately justified through application of learning theory, a worthwhile endeavor that we now venture to undertake.

The Seven Principles were originally created for and in a time previous to the online instruction boom of the last decade. Because there are inherent differences in F2F and online instruction, some research has investigated whether the Seven Principles were evident in online instruction (Batts, 2008; Batts, et al., 2006; Tirrell & Quick, 2012). Collectively, the results have shown moderate to high occurrence of engagement in three of the Seven Principles and with low occurrences in the other four including: time on task, active learning, collaboration, and diversity (Batts, 2008). However, this data was all based on instructor and student surveys and therefore not a direct summative measure of student engagement. Even so, the recommendations of the authors included the broader inclusion of synchronous tools and increasing the use of evaluation and record keeping tools to better capture evidence of student engagement for evaluative purposes and thus the promotion of academic accountability (Batts, 2008).

Learning is innate and undeniable for animate entities. It is further understood that all organisms must react with their environment in order to survive (Saladin & Miller, 1998) and humans are uniquely evolved for an insatiable desire to learn in everything we do (Bruner, 1966). In theory, it is not what we strive to do, but what we can't help but do simply by *being*. The most renowned early American educational philosopher, John Dewey, is credited with defining the concept of experiential learning that arises between a human and the environment in which they interact. As proposed by Dewey (1938) learning arises only through the process of doing things or by having and participating in experiences. In addition, Dewey (1938) suggested that learning was much broader than subject matter content by saying "perhaps the greatest of all pedagogical fallacies is the notion that a person learns only the particular thing he is

studying at the time" (p. 48). This meant that there is learning not just in things we set out to learn through intentional efforts, but also through subconscious and poorly understood sensory (e.g. sights, smells, sounds, touch, emotions) elements that are also assimilated into the human experience that may or may not be of the cognitive domain. While Dewey was using the term *experience*, the concept is the same as what we are now referring to as *engagement*. Through life, more experiences and thus more engagement with the environment means more *learning*.

As an important aspect, throughout this document there is a need for a clear definition of learning. Dewey (1938) believed the more appropriate term for learning was *growth*, not just in a physical form, but also of a psychological form where the assimilation of knowledge through experience over time influenced the behavior of the learner. He displayed personal debate over the direction of growth and suggested that even though growth would be innately embedded in the infinite number of factors in an environment, desired and thus education-derived growth would need to include a vector definition. By including this concept, Dewey (1938) sought to explain growth in directions that were societally determined to be detrimental (i.e. such as the police avoidance skills of a robber) and mandated that educational intentions include both magnitude of growth but also a directional factor as well. While it is agreed upon that learning represents a relationship between learner and the environment in which they exist, Bruner (1990), expanded and elucidated this description by later saying that:

> It is culture, not biology, that shapes human life and the human mind, that gives meaning to action by situating its underlying intentional states in an interpretive system. It does this by imposing the patterns inherent in the culture's symbolic

> systems-its language and discourse modes, the forms of logical and narrative explication, and the patterns of mutually dependent communal life. (p. 34)

By working towards dispelling the teacher centric and student-absorbed mentality of what he called traditional educational techniques, Dewey was a part of an attempted revolution in education during the earlier parts of the 20th century. Bruner (1966), in later commentary, like Dewey (1938) described learning as best classified as the process of personal growth. In doing so, Bruner characterized six specific patterns or characteristics of growth including: (a) increased independence of response from the immediate nature of the stimulus, (b) internalizing events into a *storage system* that corresponds to the environment, (c) capacity to communicate internally and externally what one has done or will do, (d) interactions between a learner and a mentor, (e) mediated through language, (f) increasing capacity to multitask in thought in nonlinear sequences.

These six factors demonstrate the absolute complexity of learning. First and foremost, it is necessary to point out that learning is something that is a process and not a state as displayed in the language of flux (i.e. enhancing, decreasing, internalizing) used by Bruner (1966) himself. The characteristics posited by Bruner (1966) reveal much about the way humans move through life and what would be considered growth (or learning). The first deals with a movement from behaviorism towards one dependent on higher cognitive power where a stimulus does not produce the same predictable mechanical response that might be seen in lower animals. The second is one that mentions the seemingly infinite capacity of memory that the human mind possesses. Bruner (1966) further suggests that simple storage of facts and memories is insufficient in fully detailing this characteristic. Rather, the full picture includes how these memories

influence the ability to make predictions or extrapolate to novel scenarios of which the learner is previously unaware, which is similar to much later theoretical work produced by Hawkins and Blakeslee (2004). Language is a very powerful third pattern that includes all levels of communication including that directed inwards as well as that directed towards others (Bruner, 1966). It is very important to note that language in the spoken or written sense, as perhaps classically considered, is entirely too narrow since language includes what are known as words but also signs and symbols (of which written language is one) (Vygotsky, 1978). These can manifest only in the physical as exemplified by an infant's pointing, to color or shape codes associated with road signs, or to perceptions or body language during interpersonal communication (Bruner, 1966). All of this communication is critically framed both in past occurrences and those of the future, which are contingent on the aforementioned storage system of humans. The fourth characteristic of Bruner's (1966) learning model is that of social interaction between a learner and what he termed a tutor. Bruner's (1966) work is highly dependent on the cultural aspects of meaning. In essence, his theories require an acceptance of the premise that the individual does not exist in a vacuum and in fact is embedded throughout the lifespan in culturally mediated experiences that are determined by other individuals. In turn, these individuals each under the influence of others' such that society and all individuals are in fact a product of all previous and currently existing member of society (Bruner, 1966). Furthermore, the mentor thus has the power to guide the learner through a wide array of activities through planning resulting in time dependent and relevant feedback. In an aside, this is similar to the writings of Vygotsky (1978) who wrote of the ideal efficiency of learning that can be produced through the utilization of a tutor of

similar but definitely higher aptitude than the individual in question. The resulting zone of proximal development as Vygotsky called it would benefit the learner to the greatest extent by closely pairing individuals with similar experiences, language, emotions, and credibility with one another to produce an effectual bridge between the "independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86). Actual language gets additional attention here in the fifth characteristic of growth in Bruner's (1966) model. Teachers must communicate to pupils through a language that is commonly understood by both. This language also serves to move the learner to grow through providing the means by which the learner produces personalized meaning resulting from their respective interactions with the world. The sixth and final point is that growth produces an ever-increasing ability to cogitate about multiple pieces of data, in a non-sequential manner where the thinker weighs multiple possible outcomes simultaneously (Bruner, 1966). All of this further takes place in a space where prioritization and allocation of time to these thoughts is constantly weighed to produce action in an appropriate manner.

Academic challenge. Dewey (1938), who criticized superficially generated instructional activities by stating "the belief that all genuine education comes about from experience does not mean that all experiences are genuinely or equally educative" (p. 25). Doing something is not to be taken as the intention of experiential learning, rather learning can be more efficient if care is taken to properly choose and implement certain activities that are more conducive to educational objectives than others. In short, students actively doing *something* is not the pinnacle of facilitated instruction. Care must

therefore be given to each and every strategy that educators use to promote learning in the desired direction.

According to the NSSE (2011), academic challenges are provided by universities and colleges that "promote high levels of student achievement by setting high expectations for student performance" (p. 33). Speaking in a different but similar topic, Dewey (1938) wrote of this:

> the trouble with traditional education was not that educators took upon themselves the responsibility for providing an environment. The trouble was that they did not consider the other factor in creating an experience; namely, the powers and purposes of those taught. (p. 45)

Here, he suggests that too much attention had classically been paid to a knowledgeable and experienced educator providing information that students need to know through dictatorial mechanisms with less attention to the innate and inalienable human pursuit of growth. Humans are capable of great strides in educating themselves and not everything must be intentionally transferred from one person to another. Furthermore, implied here is the sense that education is not a finite end to which we endeavor to have our students reach. Nor should we limit the expectation of achievement in some sort of standardized manner where the perspective of the instructor or institution defines arbitrarily an endpoint or benchmark that is success. Rather, by setting high expectations and challenging students to loftier, individualized goals we can better hope to encourage each student's attainment of their own respective potential (Reynolds, 1995).

The NSSE attempts to quantify academic challenge and expectations indirectly through surveying student reports of the number and depth of assignments that they are

expected to complete during their academic careers. In the original NSSE from 2001, the survey items dedicated to indirectly assessing academic challenge included the time preparing for class, the quality and quantity of reading and writing, working harder and achieving more than what students thought they previously could to meet instructor expectations (National Survey for Student Engagement, 2000). Another area of inquiry was the prioritization of higher levels of cognitive processing first categorized by Bloom, Englehart, Furst, Hill, and Kratwohl (1956) as analysis, synthesis, evaluation, and application. In addressing cognitive level in online education as a whole (Batts, et al., 2006; Chen, et al., 2010; Robinson & Hullinger, 2008), synchronous class events in particular have been shown to support academic rigor as defined by NSSE through the inclusion of activities related to the promotion of critical thinking (Mcalister, et al., 2004) problem-solving activities (Ingram, et al., 2000), application to individual experience and resulting reflective exercises (Burnett, 2003; Kirk, 2000). One inherent aspect of academic and intellectual challenge is the current web-conferencing synchronous sessions that include the difficulty of placing higher cognitive load on students due to multimodal feeds simultaneously such as whiteboards, polling, responses, chats, audio and video (Herring, 1999; Kear, Chetwynd, Williams, & Donelan, 2011). While the authors suggested this would represent a content negative, it is possible that students exposed to this multimodal model might develop greater skill in this area due to the challenge of filtering and attending to the many sources of information simultaneously.

Interactions. Dominating the last half of the 20th century in educational literature were the principles associated with social learning theory. At the core of social learning theory lies the concept that the learner is inseparably embedded in an environment that

has been influenced by the human world and therefore subject to influence from predecessors and the artifacts created by these predecessors. Dewey believed that (1938) "the principle that development of experience comes about through interaction means that education is essentially a social process" (p. 58) and that this meant for learning to take place, there must be some form of interaction between two or more humans. What is not to be missed here is that interactions can occur across a broad spectrum but can be either live (synchronous) or through mediated artifacts (asynchronous) forms of communication. Sharing a dialogue of language in realtime, either in the same physical space of with the aid of distance-bridging technological means, are overt examples of social interaction that promotes a shared learning experience. However and perhaps much more significant to the exponential accrual of humankind, knowledge represents the reified artifacts of human experience (Vygotsky, 1978). Written, visual, or physical works represent formerly acquired and applied human knowledge in a form that can be passed asynchronously from one person to the next are artifacts of culture. In order to facilitate this culturally passed on knowledge of previous experience Dewey (1938) suggested that:

> the educator is responsible for a knowledge of individuals and for a knowledge of subject-matter that would enable activities to be selected which lend themselves to social organization, an organization in which all individuals have an opportunity to contribute something, and in which the activities in which all participate are the chief carrier of control. (p. 56)

Thus, to promote learning, it is necessary to choose activities and exercises embedded in an environment that is both hospitable and conducive to active participation in a multi-level, shared, and collaborative manner.

The next category of NSSE engagement to address is therefore the combined categories of a) active and b) collaborative learning together with c) student-faculty interaction. While these are separately quantified NSSE categories, both collaboration and interaction inherently require interpersonal communication in some form between at least two people and thus deserve combined attention. As summarized by Repman et al. (2005), the synchronous chat alone can simulate classroom environments (Ingram, et al., 2000) which are useful in both student-student (Eastman & Swift, 2002) and faculty-student interaction (Wang & Newlin, 2001). The nature of chat-only communication, which has been around much longer than webconferencing software tools, has produced a large body of interesting work into the differences between chat and personal communication. This work includes investigations into the effect that a text-based only communication has on interpersonal communication.

One major area is the effect that the perception of anonymity has on chat behavior. As suggested by Joinson, (2001) chat facilitates greater personal disclosure than F2F, anonymity promotes self-disclosure, and both public and private self-awareness are negatively associated with self-disclosure. The authors operated with self-disclosure defined as the "act of revealing personal information to others" (Wegner & Vallacher, 1980, p. 183) and conducted this work in a three-tiered set of controlled experiments. First, they confirmed that student disclosure to a faculty and peer audience was higher with chat vs. F2F. The second line of inquiry was to investigate differences in chat with

the influences of visual anonymity. The study showed that whether or not you can see the other participants in the chat communication does in fact relate inversely to the amount of disclosure (Joinson, 2001). A final third study looked at the interaction of public and private anonymity factors (awareness) as they related to chat behavior. In short, the evidence demonstrated that when participants are less aware of themselves and their presence amongst others, they are more fully engaged in the conversation as quantified by length, depth, and frequency of chat (Joinson, 2001). This becomes a powerful finding for those interested in promoting more open and honest dialogue between students in a controlled learning environment.

In later follow-up work, Joinson et al. (Joinson, Reips, Buchanan, & Schofield, 2010) performed another series of studies investigating the interaction of privacy and trust on self-disclosure. In the first study, it was found (not surprisingly) that trust was directly correlated with personal sharing in online communities. Secondly, the primary mediating factor in this relationship was reported as perceived privacy. That was followed by a study that determined that some level of compensation between trust and perceived privacy moderated participant disclosure. In essence, it was found that to some degree a low perception of privacy could be overcome through a high trust factor and vice versa. The two Joinson (2001; 2010) works combine to gives us insight as to the potential power and pitfalls of this burgeoning form of interaction.

Collectively we learn that synchronous online communications might promote interaction of students by disengaging them from the physical proximity to others and by de-emphasizing visual cues of self and others– both of which might otherwise be inhibiting to interaction. Furthermore, we might be able to promote disclosure and

student-student and faculty-student interactions through weighing both trust and perception of privacy in our online activities.

Investigations of a synchronous webconferencing tool have also revealed a potential difference in participant personality. The authors suggested that individuals who self-identified as being shy preferred an online model (Valaitis, et al., 2007). Also, in building relationships, shy people report closer and more satisfying relationships than those who indicate lower levels of shyness (Sheeks & Birchmeier, 2007). However, shy people although inclined towards chat, might be more disposed towards asynchronous forms due to the requirement of speed in interpreting textual clues and providing immediate feedback during chat (Chan, 2011). In summary of the Joinson (2001; 2010) works and personality related findings (Chan, 2011; Sheeks & Birchmeier, 2007; Valaitis, et al., 2007) there is evidence that suggests that just because we can utilize technology to mimic very closely F2F, perhaps this would be a disadvantage to the additional disclosure that might occur with an entirely online and more visually anonymous webconferencing tool.

Active learning and collaboration. In the Dewian (1916) spirit of experiential education, NSSE attempts to measure the level of student engagement through the frequency and quality of active participation both inside and outside of class. Active learning speaks to the *empty vessel* concept that frequently enters discussions on educational theory. Inherent in the concept of *active learning* is that knowledge is created through problem solving experiences individual to the learner and cannot be forced in. Moreover, worthwhile, long-lasting experiences must arise and be promoted through facilitation of self-generated means. In simpler terms, information and

knowledge cannot be passed from a more capable person into the memory of a learner through passive means (i.e. the learner must…*learn* not receive). In essence, we know that the minds of students are not *empty vessels* that can be filled by external means such as a teacher pouring knowledge into a passively receiving student. Collaborative learning is supported by social learning theory (Bruner, 1966; Vygotsky, 1978) and by its nature mandates that two or more people communicate with one another in the pursuit of educational goals. We can find evidence of this category of engagement through quantifying the contributions in the form of questions or participation in course discussions, presenting in class, working with peers during and outside of class time, tutoring or mentoring others, completing community based projects, or discussing ideas and course content with others outside of class (National Survey for Student Engagement, 2011).

In social learning constructs, while the actions and meaning-making of the learner need to be individualized for personal growth, they must occur in the presence of others either in the form of reified materials or realtime correspondence. Speaking as to the role of the instructor in this process, Dewey (1938) said, "when education is based upon experience and educative experience is seen to be a social process, the situation changes radically" and that instructors need to be made aware of the idea that under these conditions, "the teacher loses the position of external boss but takes on that of leader of group activities" (p. 59). Historically, this was seen as a potentially negative thing, where the instructor would be de-emphasized in the learning process and become more a facilitator or enabler for social conditions between peers to play a more prominent role in the learning processes of individuals. However, Bruner's viewpoint on feedback helps us

to understand how increased focus on the learner-learner interaction can be so valuable. Bruner (1966) surmised that knowledge transference from instructor to learner need occur in a common area of understanding between the two parties. Simply stated, "if information is to be used effectively [by the learner], it must be translated into the learner's way of attempting to solve a problem" (Bruner, 1966, p. 53). Others have referred to this as scaffolding, which metaphorically denotes the intentional steering of the learner from areas of current understanding towards new knowledge through stepwise actions that build progressively on one another (Van De Pol, Volman, & Beishuizen, 2010). Van de Pol et al. (2010), borrowing from Stone (1993) stated that learning was predicated on moving first from social levels (external), then to individual (internal) levels, where "participants actively build common understanding or intersubjectivity through communicative exchanges in which the student learns from the perspective of the more knowledgeable other" (p. 272). In providing a base for the later work of van de Pol et al., (2010), Vygotsky (1978) is credited with the creation of a *zone of proximal development* defined as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). In many cases, Vygotsky argued, the greater distance between learner and instructor could be inhibitory to a successful learning experience. This was due to a mismatch between the language and experiences that the mentor would have at their disposal. Having no knowledge of these experiences and being unable to understand the jargon, examples, or metaphors provided by the mentor, all cues would be virtually useless in principle to the learner. Bruner (1966) succinctly

stated that feedback that "exceeds the information-processing capacities of the learner is obviously wasted" (Bruner, 1966). Therefore, it becomes advantageous to have an exceptionally talented and trained mentor who could intentionally behave in a manner such as to mimic a more novice learner. A second method is to narrow this gap between learner and instructor through peer-to-peer interactions where differences in competence would be fundamentally reduced.

Putting this altogether, social learning theory states that learning occurs mandatorily via communication (either synchronous or asynchronous) between individuals. While all communication is useful, peer-to peer interaction has advantages through references to the zone of proximal development in promoting shared learning experiences that do not "create a form of mastery that is contingent upon the perpetual presence of the teacher" (Bruner, 1966, p. 53). The degree to which online synchronous tools can facilitate learner-learner interaction can help to shape the future of online learning and is thus a valuable undertaking.

One of the more interesting lines of research currently underway comes from the language and linguistic disciplines. Here we learn that the form of instantaneous chat utilized in synchronous tools is a mediating device that is necessitating and facilitating the development of a new form of language. Ever-so frustrating for the newcomer to digital textual communication, the research here is critical to developing a set of best practices of engaging our students in ways more conducive to their learning. First, in being able to understand the forms of interaction that students are having amongst themselves and second, if we are made more aware as instructors we are more likely to be able to use these tools to achieve the learning objectives we set for our students.

What necessitates this divergence of language is that unlike spoken F2F communication, synchronous chats are a form of communication that blends both textual and spoken forms of communication (Herring, 1996) and therefore might actually present less as a hybrid and more as a unique emergent form of communication altogether (Greenberg, 2008; Savas, 2011). Using the framework of Brown & Yule (1983) who delineated the difference between written and spoken forms of language, to identify the unique nature of synchronous chats Savas (2011) produced the following list of seven distinct differences. First, we see that (a) paralinguistic (body language) cues that are so common in spoken communication are possible with textual communication in the strict sense. However, efforts can be made by students to include references to this information although, this exchange must still be transcribed to text and does not occur in the concurrent timeframe and might in fact occur subconsciously. Unlike spoken communication, (b) chats are more like written communication in that they are typically recorded and available for future reference. Next, (c) anonymity is more easily pursued in chat communication compared to spoken F2F dialogue where no visual feedback is available to students. Depending on how the chat is set up, anonymity can be complete or partial and students might volunteer this information freely throughout the exchange. Differences exist in language syntax where (d) spoken is less formal than written. Again, some choice evidence suggests that there are students who are more inclined to adhere to the canon of spoken rules while others are more apt to adhere to written rules (Savas, 2011). It is suggested that a natural trend exists where novice chat students will tend to initially chat with written rules and segue towards a more spoken set of standards with experience and familiarity with this new community of practice. Chats can promote contextual meaning

through the use of emoticons, but specific and concurrent transfer of this information is indeed markedly different than in F2F. Therefore, (e) subtle references to contextual factors such as time, environmental conditions, and the presence of other individuals also play a role in spoken but not as much in written communication. The informal practice of altering one's thoughts midstream are often frowned upon with written composition and avoided in academic endeavors entirely. Nonetheless, (f) amending spoken language during a particular statement is extremely common and although difficult, this can also be accomplished in synchronous chats through the process of increased rate of *turn-taking* when multiple posts are submitted in the delivery of a single thought of *turn* by one individual. Because of the typically faster rate of exchange, another practice of spoken language is the (g) use of unimportant or superficial *fillers* that allow a speaker time to cogitate and transition between statements. This practice is avoided in written composition but supported well in synchronous chats whereby, in "posting short expressions [,] the chatter gains time to think while he or she is formulating a response or reading other posts. This practice is similar to using gap-fillers such as: well, you know, and what I mean in spoken language" (Savas, 2011, p. 303). The bottom line here is that textual online synchronous communication is an emerging language in and of itself that will take time for novices to assimilate to. However, it is important to note that care should perhaps be afforded to draw lines of intent with informal student communication. At all times, it is encouraged that students provide clear and coherent communications to the cultural acceptance of the group (community) they are communicating with at the time. Notwithstanding, it is important for instructors to appreciate the more innate aspect

of student-student interactions seen using this form of language, and perhaps not only allow it, but also work to facilitate it for the promotion of interaction.

Student-faculty interaction. Student faculty interaction is one of the hallmark assumptions of institutional education and learning theory. On the role that instructors have in the life and growth of learners, Dewey (1938) stated that:

> a primary responsibility of educators is that they not only be aware of the principle of the shaping of actual experience by environing conditions, but that they also recognize in the concrete what surroundings are conducive to having experiences which lead to growth. Above all, they should know how to utilize the surroundings, physical and social, that exist as to extract from them all that they have to contribute to building up experiences that are worth while. (Dewey, 1938, p. 40)

Instructors therefore have numerous, simultaneous responsibilities to the students all for the sake of student learning. While there is a need to help students learn the curriculum of any give class, there is a need for this to go beyond the unilateral classroom lecture. For as Bruner said if our instruction is to be successful it "must contain different ways of activating children, different ways of presenting sequences, different opportunities for some children to "skip" parts while others work their way through, different ways of putting things" (Bruner, 1966, p. 71). Additional time of the instructor given to the student where time can be dedicated to the specific needs of each learner is critical in a customized and thus more effective learning model. Formal and informal learner-instructor interactions are both important and can occur at ay time whether in the class or

out. By nature, it is more likely that interactions surrounding class time are more likely to be of a curricular form and more impromptu exchanges are to be of a more social or personal type. Nonetheless, in an effort to quantify learner-instructor interaction, the NSSE survey looks for evidence of this through the discussion of grades, or learning expectations, discussions with faculty outside of class time, career and personal mentorship, feedback on academic performance of any kind, and additional work with faculty instructors on outside of class work such as research projects and independent studies (National Survey for Student Engagement, 2011).

While the preceding works discussed to this point targeted the environment and students themselves, other studies have investigated the effect of the instructor has on chat interactions. In the most important study along these lines for this proposal, Burnett (2003), set out to "define effective tutor behavior" (p. 247) in this relatively new instructional tool . Citing major differences between classical faculty-centric delivered instruction and F2F environments, it was postulated that differences would exist in moderating live discussions because the instructor in online chats have been reduced to a student equivalent in visual and physical appearance. In preparing the analysis, Burnett (2003) borrowed from Mason (1991) in investigating if and how all instructor posts (or moves) could be classified into three purposeful categories: social, organizational, and intellectual. Understanding each of these areas and the ways in which instructors could promote each area to fit the given activity or learning objective at the time was necessary to improve pedagogy in online curricula.

Social. Setting out to identify instructor techniques aimed at promoting social interaction in synchronous class sessions, Burnett (2003) defined social aspects through

the establishment of a "supportive atmosphere among a group of people unable to see one another" (p. 250). Following the examination of online chat transcripts for teaching in continuing education, examples of instructor facilitated social promotion included encouraging social interactions, affirming individuals' comments, and developing informal use of language. Beyond learning paradigms, social integration has been shown to be an important marker for persistence and achievement in online education (Rovai, 2003).

Social interaction could commonly appear at the start and end of each class period where in parallel to F2F sessions, the instructor solicits commentary and conversation about the past weekend, recent sporting news, current events, or movies that have been seen in common. Other inquiries could be of a more personal nature such as sharing what projects the instructor has been worked on recently and asking for others to share in reciprocation. Along these lines of fostering social interaction, at least one other study has set out to characterize the direct relationship of social interaction mediated by between instructor presence and participant behavior. Kear et al. (2011) suggested that the role of the facilitator plays a crucial role in promoting interactions amongst students. Their study, assessed instructor and student behaviors and perceptions regarding webconferencing software in an online learning module. The authors concluded that the primary finding was a potential difficulty with creating a social presence. In particular, new instructors who are unfamiliar with the functionality of synchronous instruction can be over-dedicated to a planned, structured lesson and less able to navigate an environment, which to some extent is intrinsically student-centered. This brings a greater occurrence of topic divergence and difficulty for all instructors especially novices

attempting to facilitate improvisation (Kear, et al., 2011). Kear et al. (2011) then suggested this might be mitigated with extensive instructor preparation. An additional finding was that instructor presence might to some extent impede the flow of interaction between students. The authors offered that "there is some evidence to suggest that student-to-student interaction is more likely to take place when the tutor is not present, so this could be encouraged by using breakout rooms" (Kear, et al., 2011, p. 961).

Social presence and allowance will likely promote group cohesion and increase the likelihood that students will become more engaged. This might arise from increasing trust variables or possibly by decreasing external (instructor) awareness (Joinson, 2001; Joinson, et al., 2010), facilitating a move to the learning community (Lave & Wenger, 1991), or perhaps through personality inclusive actions (Valaitis, et al., 2007). Whatever the mechanism, the investigation and further classification of instructor tactics to promote social interaction are critical in promoting engagement in synchronous online class sessions.

Organizational. Mason's (1991) definition of organizational moves led Burnett (2003) to identify subcategories including a) directing, b) selecting, c) summarizing, d) selecting and waiting, and e) maintaining multiple strands. *Directing* is one of the most common techniques and would include items such as prepared questions to pose to initiate discussion or using command-like language to symbolize the end of one line of conversation and the creation of a new content thread. This tactic is often necessary and similar to a F2F model where, after initial announcements and chatter the professor might lead students to close this conversation and begin the discussions on the chapter of the day. *Selecting* refers to identifying a particular statement from a previous post and

selecting it for further discussion. This can refer to an entire comment or a segment of the comment where the instructor seeks further explanation from a misunderstood post, or asks other students to comment on something another participant has said. A useful tactic in F2F, is also relevant in online chats where following a discussion and numerous participant posts, the instructor might want to summarize the findings or conclusions before then mapping a path to the next topic. This *summarizing and redirecting* tactic is useful to wrap up one thread and move to a related or entirely new one. The summarizing option could also be posed to the students in a way that gets them to once again compile the conclusions themselves. Often following class-wide discussion, long pauses might arise where a summary of what has been presented serves as a reminder about the tasks and the ideas under discussion. A simple *restatement* of where we are and what have we just learned could serve as a reaffirmation that the conversation is continuing while allowing students additional time to respond. One of the unique aspects of online chats is the possibility of creating and *maintaining multiple strands* at the same time. Whereas in live F2F sessions, all members of the room must stay on the linear thread moderated by the one speaking individual, online chats allow for the possibility to have multiple conversations at the same time. As an exercise, the instructor could ask that all students provide a couple sentence summary of something they just read. Follow-up questions, commentary, and critiques then might ensue from the faculty and fellow students that lead to multiple side chats embedded in the broader context for all to observe. These can be confusing for the novice, but there is also potential power afforded if care is given to learn these moderations or tactics effectively (Burnett, 2003).

Intellectual. Intellectual development is possibly the cornerstone aspect of educational practice. In promoting intellectual conversation during online synchronous chats, Burnett (2003) suggested the adoption of Edwards' (1992) work in the modeling of "learning talk" (p. 257). First and foremost, this means asking questions, making declarations, and offering suppositions. But larger that this is the transference to an online chat where as Burnett (2003) suggests that tentativeness and making links to separate thoughts are challenged in a chat-only environment. What is meant by this method is to provide examples to students of thinking out loud or changing thoughts in realtime through the use of punctuation and pauses to mimic real life thought processes. This could mean a simple question mark following a self-post, a string of periods in a partial statement to denote incomplete and in-progress thinking, an *idk* (I don't know) post after a statement denoting uncertainty, or use of a self-deprecating or contextualized parenthetical. This informal use of text in the synchronous chat can be powerful in promoting group thought and encouraging sharing amongst the instructor and students. By modeling uncertainty, and process of thought, a more collective thought thread might be produced where others can contribute thoughts-in-progress in a non-intimidating environment of inclusion and safety.

With the notion to promote interactions between students and the instructor, the environment itself, the nature of the tool, and the behaviors of the instructor are critical in forming the basis for successful online instruction. By identifying tactic (moves) of the instructor as social, organizational, or intellectual in nature, we are moving closer to understanding how to best adopt strategies in matching our particular learning objectives. The summative conclusion of the work of Burnett (2003) was to suggest that instructors

be made aware of differences existing in the effectiveness of certain instructor moves, embrace and foster linguistic variability and creativity when possible, and take advantage of the nature of synchronous chats which allows for multi-stranding.

Enriching educational experiences. The identification of what constitutes a rich learning experience has some similarity and crossover to the concept of academic challenge. However, what sets this category apart is not as much the amount of work, but the type of work that is provided to and expected from students. Another word used in higher education is *transformation* and enriching experiences includes some of this ideal. Perhaps this is best expressed by Dewey (1938) who stated "the central problem of an education based experience is to select the kind of present experiences that live fruitfully and creatively in subsequent experiences" (pp. 27-28). Here, he suggests that it should not be the objective of institutions just to promote a learning of the facts, events, and players from the past, but to create in each student a scenario whereby they are fundamentally different from when they began their educational trek and furthermore, that following their academic careers, they will be more likely to engage in further, optional experiences. This transformation comes largely from providing students opportunities to participate in activities and with people that they had not yet been engaged with. Through greater exposure to diversity of people, experience, activities, religion, background, or political beliefs, learners might transform themselves over time into more fully prepared, confident, and worldly individuals (Humphreys, 2000; Institute of Medicine, 2004). Some of the evidence from the NSSE survey used in assessing this engagement comes from having conversations with diverse groups or people and especially those that are different that the participant. Extracurricular activities (e.g.

sports, student government, service organizations, Greek life, clubs, etc.), discipline specific work or internships, and culminating senior-level thesis or projects are included and internationalization exposure seen through travel, alternative breaks, study abroad, or foreign language study are all areas that promote enriching educational experiences (National Survey for Student Engagement, 2011).

Arising from social learning theory, the theoretical model known as *community of practice* (CoP) has origins in the works of Jean Lave and Etienne Wenger. As stated by Lave & Wenger (1991)

> learning viewed as situated activity has as its central defining characteristic a process we call *legitimate peripheral participation*. By this we mean to draw attention to the point that learners inevitably participate in communities of practitioners and that the mastery of knowledge and skill requires newcomers to move towards full participation in the sociocultural practices of a community. (p. 29)

A CoP is a useful model to discuss what is meant by an enriching educational experience through a discussion about legitimate participation in activities that are useful outside of academia. As assessed in the NSSE data, are internships, study abroad, community service, and field experiences- all of which represent bridges of authenticity to student accomplishment and experience that is much larger than classwork. These types of activities instead expose student to personal, and professional lives that they will encounter when their degrees are completed and they move away from the university. In short, instead of learning about tasks they might tackle after graduation, they are actually

beginning to tackle these activities in a supervised and supportive, apprentice-style manner.

From the time of their first major work *Situated Learning: Legitimate peripheral participation* (Lave & Wenger, 1991) a CoP has become one of the most accepted and well-researched areas of educational theory. Inherent in this work is the notion that learning comes from the process of novice participants entering into an existing community of more experienced individuals through participation in in that community over time. According to Lave (1991) the key phrases in deciphering these processes are *apprenticeship* and *situated learning*. While the term is credited to Lave and Wenger (1991), *situated learning* takes on special meaning across the educational commentary of multiple predecessors. Dewey (1938) some half-century earlier suggested "there is no such thing as educational value in the abstract" (p. 46) and that "perhaps the greatest of all pedagogical fallacies is the notion that a person learns only the particular thing he is studying at the time" (p. 48). These bold statements lead us to have a better understanding that while studying the cellular composition of kidney tubules for example, a learner is simultaneously engaged in infinite other formal and informal inputs related to the environment which include the social interactions of peers, sensory perceptions, format and language of the book authors, and the sequencing of questioning that is programming their activities amidst others. Literally everything in the environment contributes to the experience being had at that moment and all collectively form the learning experience. Bruner (1966) additionally touches on this when suggesting that:

> what must be plain…is that the issues to be faced are far broader than those conventionally comprised in what is called "education"… Our proper subject is,

> of course, how a culture is transmitted - its skills, values, style, technology, and wisdom-and how, in transmission, it produces more effective and zestful human beings. (p. 149)

Thus, educators are better suited to serve the growth of their student's generalizable capacity and ability to learn all things, not just (as Dewey said) what they are learning at the time.

For eons, learning took place to a high extent in multiple levels of human interaction before the notion of institutionalized education became available to the masses. Observing such examples in modern applications, Lave and Wenger (1991) found that midwives, tailors, butchers, and nondrinking (recovering) alcoholics represented groups of individuals where a fully functioning assimilation of a set of both transparent and discernible knowledge, skills, and culture transfer in practice. A relationship between expert and novice has traditionally been referred to as that between an apprentice and a master or mentor. The descriptive process of this interplay and resulting transfer of practice competence from master to novice became known as situated learning. This sociocultural practice is considered to be one of diverse nature but involves social interaction, individuals engaging in a common goal, and a gradual evolution of the community and possibly its practices by the members of the community over time (Lave & Wenger, 1991).

One of the fundamental aspects of CoPs is the way in which knowledge and information is made available to and passed on to the members of the community and thus serves as the means by which members participating in a peripheral, less involved manner can become fully active members in the community. Information transfer in

online education can result from a multitude of different forms. Specifically to synchronous communication this can include direct interactions with other members of the CoP in the spoken or textual word, personal experiences gained from legitimately participating in the activities of a learner CoP, all while enmeshing oneself in a supportive technological interface that might represent a future professional form of interaction.

Enriching academic experiences describes a type of engagement that identifies areas by which universities can expose students to diversity of being and of thought. Moving students to activities that are less about performing academic exercises for the sake of academics alone and towards legitimate personal, social, service, and professional activities are marks of an enriched academic experience engagement. The social learning model known as communities of practice is useful in understanding the interplay between instructor and learner in any form but especially in an online synchronous one. While we each are member of potentially dozens of different CoPs at any one time in varying degrees, synchronous tools can provide enriching academic support necessary for movement of students from peripheral to legitimate participation in their multiple chosen communities or practice.

Supportive campus environments. Student success is brought about and nurtured when there seems to be a synergistic bilateral credibility between student and institution. In this way, the student is more successful if the student perceives the institution is acting in their best interest and the reverse holds true as well (National Survey for Student Engagement, 2011). Above all, universities need create and maintain a supportive environment where they "utilize the surroundings, physical and social, that

exist as to extract from them all that they have to contribute to building up experiences that are worth while" (Dewey, 1938, p. 40). The creation of a supportive campus environment includes *whole-person* (Loyola Marymount University, 2011) support for academic, personal, spiritual, social, physical, and emotional development. These sorts of support mechanisms would be not just in the physical spaces such as classrooms, recreational facilities, and residences, but also in the programs and personnel to staff these features. In addressing this category of engagement, there would be two major evidences relevant to this proposal, those directed at the individual and those directed at the logistical. Speaking to the individual, trust, privacy, and personality are just some of the factors that play a role in the level of engagement with synchronous online chats. Possibly because chats can promote democratic, student-centric relationships (French, et al., 1999), synchronous are better at developing community and social presence, spontaneity, emotive responses (Johnson, 2006). Nonetheless, providing the right mixture of these during class sessions would be desired. Logistical factors would occur mostly from a standpoint of technical issues. Clearly, despite an evermore technologically native groups of students entering higher education (Dahlstrom, et al., 2011), there is increased need for building seamless instructional tools, including introductory training to technology, and providing adequate trouble shooting throughout our technology mediated instruction (Anderson, Fyvie, Koritko, McCarthy, Paz, Rizzuto, Tremblay, & Sawyers, 2006; Beldarrain, 2006; Dahlstrom, et al., 2011; Laird & Kuh, 2005; Renes & Strange, 2011). First and foremost, this should include training to promote the understanding of differences of instructional methods in order to avoid the simple pitfall where F2F classes are repackaged without modification in an online format

(Renes & Strange, 2011). Another aspect that might be overlooked commonly is the influence of teacher training to provide not only adequate technological expertise, but to provide instructors with the student-perspective of online learning. One study that examined veteran instructors in a continuing education model "also commented that they would appreciate some experience of being a student within the environment, so they would know how the interface looked to students" (Kear, et al., 2011, p. 961). In viewing online synchronous transcripts, it will be necessary to look for evidence of support both on the individual and logistical side when seeking to characterize student engagement. In either ad hoc or programmed activities, the transcripts might reveal evidence of supporting the student's learning the operations of a new tool or the student's personal challenges with the material and academics in general.

Summary

Student engagement has been prioritized as the fundamental goal of educational practice. The Seven Principles were created with the intention to clarify what constitutes effective goals for student engagement in promoting learning in higher education. Because the Seven Principles were developed for F2F instruction and previous to the world of the Internet, others have sought to validate the Seven Principles to online educational practices (Batts, 2008; Batts, et al., 2006; Chen, et al., 2010; Robinson & Hullinger, 2008; Thurmond, Wambach, Connors, & Frey, 2002). However, the work here is not done. Because online education is a relatively new, a number of questions still persist as how best to promote student engagement in this new practice. While some have investigated engagement from a retrospective survey based form in online

education, there is a scarcity of work identifying actual instances of engagement (Batts, 2008; Batts, et al., 2006; Tirrell & Quick, 2012). An additional compounding variable is the very nature of online deliveries, which are supported exclusively by technological tools. By its intrinsic properties, technology is a rapidly evolving field offering new possibilities on a continual basis (Bruner, 1966). As never before, powerful synchronous tools allow for large, diverse communities across distances and time to utilize instantaneous multimodal interactions with an integrated mix of text, video, and audio (Glenn & D'Agostino, 2008) for the potential betterment of students now and into the future (Tamim, Bernard, Borokhovski, Abrami, & Schmid, 2011).

Chapter 3 – Methodology

Online courses represent new territory for most of the LMU community. There is no difference seen in this phenomenon in the College of Science and Engineering where only a couple of math courses have historically been offered online. However, as per dean mandate, two sections of nutrition courses provided through an entirely online format were placed on the schedule for the summer of 2011. In an attempt to document the success and failure of these courses, an extensive summative questionnaire was given to students in the last week of each course. The questionnaire contained both quantitative data in the form of Likert (1-5) numeric responses and qualitative open-ended interview questions. Additionally, one of the mediating learning tools selected was a virtual synchronous class meeting supported through either Adobe Connect (Summer Session I) or Cisco Webex (Summer Session II). All class sessions were recorded originally for instructional purposes so that students who had to miss class could view the recordings at a later time and students wishing to re-watch portions of the class were free to do this at their own discretion. All recordings captured data in terms of chat messaging, video screen capture, and audio/video feeds of all students.

In order to summarize the effectiveness of these first-of-their-kind online courses, this data was intended for summative assessment for the LMU community in portraying the successes and failures of these courses. At the time of these class sessions, LMU was participating in numerous pilot programs with the purpose of identifying a synchronous virtual class product for campus-wide license adoption. These summer nutrition programs were an official part of the pilot program that further necessitated the acquisition of data on each of the products.

This analysis also serves as a valuable resource in shaping future online courses at LMU. However, in a broader context, there is still much work that can be done to characterize the best use of virtual classroom technologies in developing student communities and providing a platform of engagement despite geographic distance. This investgiation seeks to capitalize on this existing set of data captured in the context of a normal set of instructional practices.

Restatement of Research Questions

In order to refresh the purpose of this investigation at this time for the purpose of better outlining the methodology, the following is a list of the research questions addressed in this study.

1. What are the frequencies and types of student engagement in online synchronous chat transcripts?
2. What are the frequencies and types of instructor prompt in online synchronous chat transcripts?
3. What is the relationship between instructor prompt and student engagement in online synchronous chat transcripts?
4. What is the relationship between student engagement in both final exam and overall class performance?
5. What is the relationship between instructor prompt and student engagement according to student perception?

Research Design and Rationale

A mixed methods concurrent embedded design was performed on pre-existing data (Creswell & Clark, 2011). In this fixed design, both qualitative (numeric) and quantitative (text) data were concurrently collected previously. These data were mixed for triangulation and complementarity of findings. According to Greene, Caracelli, and Graham (1989) reasons for mixing might include: a) triangulation, b) complementarity, c) development, d) initiation, or e) expansion. These data was able to mix both objective and subjective data for *corroborative* purposes in determining student engagement and faculty action. Objective data are seen in the transcripts where evidence of student engagement was tabulated directly through observation of behavior. Similarly, direct observation of the instructor prompts was provided through careful analysis of each instructor interaction. The student derived open-ended responses helped to complement the transcript data by providing process insight into the way in which students viewed the synchronous aspects of class. This dynamic approach to design selection allows for flexibility (Hall & Howard, 2008) in catering to the unique class setting, access to data, and tools under investigation in this proposal.

Data Collection

Participants. Following IRB approval from both Pepperdine University and LMU (see Appendices A and B), a mixed-methods analysis was performed on data collected from the instruction of two classes in undergraduate nutrition delivered during the summer of 2011. A total of 27 participants (ages 19-23) representing multiple undergraduate majors formed the sample for this study. The courses were taught both as

a core science course to nonscientists and as a lower-division science elective for science majors representing pre-allied health professions. The study participants came from a diverse background of academic interests including business, liberal arts, fine arts, and the sciences. The students also displayed diversity of class year (sophomores, juniors, and seniors) as well as overall grade point average. These students and transcripts were selected because they represent a convenient, fortuitous opportunity to elucidate further the nature of synchronous online instruction. This sample, investigated with the original intent to simply assess and possibly improve the delivery of this course, now represents a great opportunity as a Scholarship of Teaching and Learning Project that could help the broader community of online educators to more closely match course learning objectives with instructional strategies in order to provide a higher quality educational product.

Class recordings. During the original class sessions, video recordings were taken consisting of the screen capture of the virtual classroom interface which included whiteboards, chat boxes, and shared images, along with all audio and video that was shared between participants and instructor. The synchronous sessions were supported through two different Internet based software packages. The first summer session used Adobe Connect™ (Version 8.0; Adobe Systems; San Jose, CA) and the second made use of Webex™ (Version 8.5; Cisco Systems Inc.; San Jose, CA). This decision occurred as LMU was participating in numerous pilot programs with the purpose of identifying a synchronous virtual class product for campus-wide license adoption. It is possible that differential systematic effects might be seen between the two sets of data as a result of these two different software packages.

Of the scheduled 20 class sessions (i.e. 10 sessions per course), 18 complete transcripts and two additional partial transcripts were available for analysis. The two entirely missing sessions are due to the recording not being started at the onset of class. In two instances, partial recordings were captured where the instructor began the recording in the middle of the session, which allows for complete analysis of the text transcripts coupled with only partial audio and video analysis. Five additional sections of recorded interactions were acquired as a method to proctor examinations to these students in this online format. During the first summer session course, three examination times were provided as an option to students throughout the day (e.g. morning, noon, evening) with only two options provided to the students in the second summer sessions (e.g. morning and evening).

The instructional intent of recording these sessions was originally purely pedagogical. Summer school online classes move remarkably fast due to the compression of 15 weeks of normal curriculum compressed into a shortened 6-week timeframe. This rapid schedule is further compounded by holidays (e.g. Memorial Day and the Fourth of July) in both sessions that further shorten the available time for class activities. Schedules are further complicated by geographic distance (and thus time zone differences) and students who in summer also frequently integrate summer employment, family vacations, and internships. Because of these myriad logistical considerations, class recordings were acquired and posted for students to view should they miss a class or simply want to revisit the recordings for study purposes at a later time. For each class section, a synchronous class session was required once per week. Scheduled on Mondays, two class sessions each week were scheduled to accommodate the varying

complexities of student availability mentioned previously. Students were asked to attend and participate fully in either one of the 90-minute synchronous sessions that were scheduled at either 8:00 am or 5:00 pm pst. Instructions were given in the syllabus and in communication during class that participation scores were (in part) to be given based on attendance, punctuality, frequency of chat posts, and participation in live discussions that were to be determined from the transcripts at a later time.

Questionnaires. An original questionnaire was created (Appendix C) and distributed to students in these subsequent sections of summer nutrition courses. These were given via an online course management system (Blackboard version 9.0; Washington, D.C.) and assigned to students on Monday with a due date of Friday during the final week of the semester. The 37-item form included open (Likert 1-5) numeric scales in questions determining level of agreement with statements such as: *The online lectures through Adobe Connect ™ were an effective use of 'classtime* and these were each followed up by open-form response instructions such as: "Please comment on the positives/negatives of the class sessions provided with Adobe Connect™ and then provide suggestions on how to improve this course requirement." These questionnaires were created in the *Survey Tool* in Blackboard™, which allows students to access the document asynchronously for individualized completion convenience. A grade-book entry was created automatically when the survey is launched to the students and upon completion, a check mark of completion appeared in the placeholder for this assignment. The responses were stored in the Blackboard™ database and available for download as a spreadsheet completely free of identifying qualifiers. Because the questionnaire was developed originally to assess student perspectives on all aspects of the online delivery of

this course, many items on the form do not directly ascertain engagement but were rather intended for descriptive information and for feedback on asynchronous activities.

Analytical Techniques

In total, there were five sets of data for analysis representing two qualitative and three quantitative forms. Qualitative data were analyzed from both the (a) transcripts and the (b) questionnaires whereas quantitative data was analyzed from the (c) survey portion of the questionnaire, (d) transcripts, and (e) course performance. In brief, the transcripts and questionnaires gave textual (qualitative insight) into elements of engagement and influence of instructor prompts. All qualitative data were coded according to the engagement and instructor prompts detailed in full below. Additional considerations were given to the possibility of emergent codes during the qualitative analysis.

Class Recordings and Transcriptions. All video recordings of class sessions (n=25; 20 class sessions, 5 exam sessions) were completely transcribed by the author into a spreadsheet format (Excel version 14.1.4; Microsoft; Redmond Way, WA). The transcriptions required the author to remove identifying features, convert all spoken audio data manually into written text, and then intertwine the chat text with the oral transcriptions into the sequence in which they occurred.

First, a text file was obtained directly at the conclusion of every class session of all written (chat) interactions during the online class period produced by the instructor or students. These files were emailed to the instructor at the conclusion of the class as the online software was being closed. During the class, these served as record of the class session for quantification of participation but were also posted on the class Learning

Management System for later review by students as necessary for make-up or study purposes. These text files included the submitter's name, time of submission, and text of transmission all in a single line of linked data. This data were removed of identifiers by assigning everyone a random number (i.e. 101, 102, 103) and replacing every name in the transcript. Often, names were used in the text of transmission such as when students would direct comments to one another or when the instructor asked a specific student to complete an activity. All of these records were also replaced with the same research identification number.

Second, the recordings were viewed and all auditory information was transcribed into text. Best efforts were made to capture auditory communication that was not word-based such as laughing, sneezing, and finger snapping when it was determined that this form of communication was relevant to interpretation by a third-party. These two sets of textual data (chat and auditory) were then interwoven so that a sequential timeline was created to most accurately represent the flow of information as it unfolded originally. Upon entry into the spreadsheet, every single line of communication identified as an audio or text based form of communication and given an *interaction type* code for later tabulation. When possible, the integrity of the flow of communication was kept intact to better convey meaning. For example, during a longer oral statement, a concurrent oral chat might have taken place where the instructor might wait until the end of a thought before returning to address the chat inquiry. Instead of breaking these oral transcripts into two separate entities, as the timeline would suggest, it was most often left as one entry with the question that followed in order to promote ease of interpretation by the research assistant who would only be privy to the written spreadsheet transcriptions. This

also served the purpose of not overly inflating the frequency of interactions of any participant. However, when in the case of two persons speaking in a conversational style, all words exchanged were captured in alternating fashion and thus as separate spreadsheet entries to best classify the back-and-forth exchange that does take place in real-time conversation.

In addition, multiple other data were captured in conjunction with the interaction data to better provide context to the coder and to allow for data filtering and later tabulations. One of these was to identify what was on the classroom screen at the time of the interaction because the instructor often displayed images from a previously prepared presentation, websites, or whiteboards for students to view during an activity. Also captured were the types of audio or visual data that was enabled at the time of the interaction such as when a student might be on camera introducing themselves and the instructor or other students would be posting chat questions or comments to the video represented individual. All of this audio or visual data was determined to fit into one of seven categories: (a) text chat only; (b) audio + chat; (c) video + chat, (d) audio + video + chat; (e) screen-share + audio + chat; (f) image slides and chat; and (g) slides + audio + chat. The research ID of the person represented or contributing to the audio or visual interaction was documented in addition to the research ID of the person in the transcribed lines interaction to discern who was on the video feed while another student asked the instructor a question. For every line of interaction, the date, class start time, session (AM or PM), semester (summer session I or summer session II), week number (1-6), software (Adobe Connect or Webex) were additionally collected for later filtering and data analysis.

Coding. For the purposes of the final data analysis, a trained research assistant completed all transcript coding. Following the preliminary identification of superficial vs. in-depth determination of every interaction entry, the interactions were identified as a form of student engagement or a form or facilitator action. Additional common text-based communications such as a smiley, jk, haha, lol, and rotf (smiling face, just kidding, laughing, laugh out loud, and rolling on the floor respectively) were considered superficial. Only the student-generated interactions were considered evidence of engagement as defined. Collaterally, only instructor generated interaction entries were deemed to be eligible for facilitator action codes. All oral and chat data, when interwoven, were intended to be accountable to the nature of the flow of the interactions. Occasionally, this resulted in long passages of uninterrupted spoken interactions where more than one code could have been identified. However, for consistency purposes, only one instance of each coded category was allowed for each interaction entry while a single entry could be judged to represent more than one entry. An example of this would be that a spoken passage of a student could demonstrate academic rigor and active learning, but only one instance of each category could be allowed for this single entry. Questions to the instructor such as: *are these steroids different from the kind you would use for health reasons? (like to treat autoimmune disease symptoms)* was found in this study to be evidencing three categories of engagement at the same time. Because the question is directed at the instructor in response to something that had just been shared, it was determined to indicate a faculty-student interaction. The student is also demonstrating academic challenge through tentativeness and difficulty with the comparison between different types of steroids and their functions in the body. Lastly, because this student is

listening and participating in the discussion with relevant inquiry and direction, this is clear evidence of active learning. As is common in text-based communication when speed and flow are important, correspondents often provided a single sentence or idea that was broken up by separate entries in a chat window. Even when these were interrupted by an additional chat from another source, this was counted as a single possible engagement entry. This was performed in order to maintain consistency with the spoken form of communication when long passages of uninterrupted communication were judged to be a single entry.

Engagement. The major dependent variable in this proposal, engagement, was operationally defined in conjunction with previous research literature (Kuh, 2003; Robinson & Hullinger, 2008) as the "time and physical activity students expend on activities relevant in their academic experience" (Robinson & Hullinger, 2008, p. 101). Expanding on this definition, other researchers have identified and described five subcategories (based on the Seven Principles) representative of student engagement which are: (a) level of academic challenge, (b) active and collaborative learning, (c) student interaction with faculty members, (d) enriching educational experiences, and (e) supportive campus environments (National Survey for Student Engagement, 2011).

Engagement for the purposes of this study included the requirement that only student contributions could be counted as providing evidence of engagement. This serves the purpose of likely increasing the consistency of coding while also adhering more closely to the NSSE (2011) policies where the students and their perceptions of engagement are the basis for engagement in the survey. The first step in the coding process for engagement required every single student entry to be classified as either

superficial or engagement. This decision was made in order to best reflect a deeper more profound evidence and thus meaning of engagement. By definition, one category of engagement is student-faculty interaction, and if a student were to respond "no" to the instructor's inquiry as to whether the student had enjoyed a good weekend, this would indeed classify as an interaction between student and faculty in the strict sense of the phrase, but this would stray from the intent behind the level necessary to count as engagement in the NSSE survey. Superficial criteria were those interactions that were binary in nature. These superficial interactions were especially common during confirmation of technological logistics where a student would inquire as to whether something was working or not. For example, a student responding: *yes* to the instructor's question of whether they could see a video was deemed to be lacking in substance sufficient to be evidence of engagement. Additional content-related, intellectual responses to questions posed by the instructor were also deemed superficial when requiring only an assent or dissent. The exception to both of these rules was when additional information provided in the same interaction provided additional commentary, support, criticism, or change of direction than what would have been provided through the primary answer of yes or no. To this matter, the code came from the ancillary material not the binary response. Finally, any line of student data, even though it was perhaps from the same instructor question stem was judged on its own merits as whether it was evidence of engagement. This practice elevated the numbers of coded engagements but this was necessary to tabulate the total of number of times that students were engaged by treating them as an individual, not as a class, a more useful measure to the purpose of this investigation.

Academic challenge. According to the National Center for Student Engagement, (2011) providing for a high level of academic challenge is critical to the engagement of students. Universities can achieve this through the promotion of "high levels of student achievement by setting high expectations for student performance (National Survey for Student Engagement, 2011, p. 33). As suggested by The National Center for Student Engagement (2000), for purpose of our qualitative analysis we sought evidence to this item through statements regarding preparing for class, reading and writing, using higher-order thinking skills, working harder than students thought they could, high professor expectations, and an institutional environment that emphasizes studying and hard work. The rigors of weekly activities, homework, and the final exam were investigated. An example of this from the data would include students saying in chat: "the conversions were tricky." One of the emergent memes requiring clarification was when students displayed confusion, uncertainty, or tentativeness with the material as they were learning it or as they were being instructed. An example of this might be (from text): "wait so froyo isn't good for diabetics?" Here, a student has been forced to rethink something that they have assumed to be true based on the lesson of the day. This presents a challenge to them as they seek rationale for this transformative way of thinking and have to spend time reassessing their internal truths.

Active and collaborative learning. Both individualized, experiential learning (Dewey, 1916) and social theories of learning (Bruner, 1966; Vygotsky, 1978; Wenger, 1998) are accepted models of educational philosophy. The incorporation of these concepts into pedagogy is valued where active and collaborative learning includes problem solving, critical thinking, and applied experiential learning, often in teams of

peers. Suspected evidence might include posing a question to peers of the professor, giving class presentations, working with classmates during or outside of class, tutoring peers or answering peer questions, and discussing readings or class activities with others (National Survey for Student Engagement, 2000). Active learning was very common in these synchronous transcripts. This was in part because every student interaction, as long as it was deemed to be not-superficial would qualify as a method whereby students were active in the "classroom." Asking questions, doing what was asked, summarizing information, sharing personal stories or experiences, giving opinions, or offering impromptu information were all examples in this data set of active and/or collaborative learning.

Student faculty interaction. Much is to be gained by students interacting with a faculty member considered an expert in the particular field of instruction they are studying. With little exception, the more time spent in contact with faculty members, the greater potential for learning exists for the student. For our practices, as recommended (National Survey for Student Engagement, 2011), student-faculty interaction included elements of role modeling, mentorship, advising, and guidance. Examples might be found through the discussion of grades or grading schemes, reflection and inquiry with readings or class assignments, career discussions, critical feedback on thoughts and assignments, and finally work towards other out-of-class activities such as research projects or service (National Survey for Student Engagement, 2011). One example of student-faculty interaction occurred following the prompt of why students had failed to achieve their self-determined assignment goals for the week in relation to exercise or nutritional behaviors. Here the student offered via chat: "@[instructor] because i wouldnt wake up.

i'd set my alarm really early and then go back to sleep. plus i rationalized if i was working out 4 days last week my goal wasn't that important." This denotes a response to the instructor's inquiry and was directed back to the instructor while reflecting personal understanding of the material in an applied manner.

Enriching educational experiences. Any effort to help students become exposed to diversity in order to grow and develop high degrees of self-actualization can be considered enriching educational opportunities (National Survey for Student Engagement, 2011). In and out of the classroom experiences that provide insight to cultural awareness through diversity, differences, and lifestyles are considered enriching factors. The utilization of technology to promote collaboration, communication, and achievement can help students engage professors, fellow students, and the community in an effort to make personalized meaning in the vein of constructionist thought (Bruner, 1966; Vygotsky, 1978). The class identified examples such as discussion about differences in cultural awareness of food choice and availability. Differences of opinion for reasons of race, ethnicity, religion or socioeconomic status are evident in dietary practices and were evaluated here. In an activity where students were asked to discuss their personal background with foods and how their experiences shape this relationship, one student remarked orally:

> Well for me I am originally from Indonesia, so my eating habits back home were drastically different. I ate a lot more rice than I do here, now I eat more bread and pasta. Also the portion sizes are completely different, the average portion back home when eating out is about half the average American size. Also because

being home, definitely I ate more home cook meals, less processed foods. Moving to America for Uni, I eat out a lot more and western food uses a lot more butter and sugar than my usual diet back home.

The evidence of diverse cultural awareness is evident in direct reference to the content of the class for others to be exposed to. This person in particular is demonstrating appreciation for two different cultures and how these cultures now have transformed her relations and understandings with food.

Supportive campus environment. Students perform better and present higher levels of satisfaction with their university experience when they are adequately supported (National Survey for Student Engagement, 2011). Anything that can be done to support students in their all-around growth is indicative of positive campus environments. Providing academic aid, institutional tutoring, coping with non-academic issues, socialization, and facilitating nurturing relationships between students, administrators, and faculty are all part of campus environments (National Survey for Student Engagement, 2011). Evidence to this might come in the form of conversations regarding personal life and challenges, discussions on time management and organizational strategies, as well as guidance on specific curricular difficulties. An example from this data for supportive campus environments came from the instructor's inquiry as to when they students would prefer deadlines for homework and one student responded in text:

"I would like Friday deadlines! The only reason I have to do so much on the weekends is because I work full timed during the week but I don't like have the

assignment still on the list of things to do. Id rather do it in the front of the week. Sunday works though!"

In this quote it is evident that, attention is being paid to the students' individual schedules and the diversity of work, academic, and personal responsibilities in this online supported course delivery. By inquiring and receiving this input, the instructor is demonstrating institutional support in the promotion of non-academic issues in conjunction with coursework.

Instructor behaviors. Our investigation of instructor prompts was defined as those that are social, organizational, or intellectual. This classification system arises from the work of Burnett (2003), who credits Mason (1991) with the identification of these three categories. The codes for the instructor behaviors were restricted of course to those interaction entries that arose from the instructor in either text of spoken form through the transcripts. Like the engagement categories, only a single incidence per entry could be recorded in every category, but multiple categories could be coded for at the same time. One example of how this could occur is with the following instructor prompt: "So next question- what are the sources of error in diet assessment?" In this one instance, it is evident that the instructor is navigating and directing the students to the next task at hand. In essence the door to the previous line of interaction is being closed and they are now being asking to engage in something else. That something else is a question directed at analyzing their experiences in an intellectual way with a dietary analysis to determine the sources of error they encountered.

We defined the *social* behavior from the instructor as chat posts directed at creating or maintaining a supportive learning environment through actions of encouraging social interactions, affirming participant ideas, and the use of informal language (Burnett, 2003). An example of social chat is provided as such:

> Uhm, alright, so we have the uh 5 of you so a small class this morning. That's a little unsettling but and I think that I am the one that's most whacked out on caffeine at this point. We have sort of a 106 up there in disguise, that's sort of interesting. It's like you're in one of those silhouette interviews like when you're hiding something in conspiracy or something like that. Uhm, and 102's in the middle of the evening still out there in Hawaii. I think she's got sunlight going to be coming up soon I hope. And I uhm, I've got a busy day planned here for us. I want to make sure.

In this excerpt, we see an entire passage of early greeting to a class where the instructor is directing specific attention to the students and their positions in the world and in a manner most likely devoid in any intellectual or content material of the day. It classifies as encouraging social interactions of the class and also exhibits informal use of language.

Mason's (1991) definition of *organizational* moves led Burnett (2003) to identify subcategories including directing, selecting, summarizing, selecting and waiting, and maintaining multiple strands. Organizational cues are given in abundance through any class scenario and in this data example from the instructor include: "Write the forst words that come to your mind regarding food when you see the following images," "so, we're going to take a few minutes to work individually," "@108 – no problem keep writing – it looks like good thought," and "WE are almost out of time. Let's recap." These instances

all give evidence to a diverse way in which the instructor can navigate and manage the synchronous online classroom. In addition, one of the unique methods of online instruction is the use of multiple threads. This data, shown in Table 1 showed multiple instances of demonstrating multiple conversations with students at the same time. Following the initial organizational prompt for all students to post an original personal experience, they were to: "Describe specific instances in you life or that of someone you know where your food habits are affected by physiological processes, meal size, composition, early experiences, ethnics customs, health concerns, advertising, social class, and economics," the students each took a couple of minutes and then as the information began coming in, follow-up questions were drafted in turn to each student to elaborate or provide additional information on their return post. The function of these posts is to continue the conversation during the time where slower students need additional time to craft their original posts, while serving the dual purpose of highlighting unique points and getting students to refine their original ideas over time.

Table 1

Example of Instructor Maintaining Multiple Strands

Research ID	Text
102	I know when I am stressed out I definitely eat a lot more, and certainly less healthfully--stress eating those comfort foods! I also tend to eat late at night if I'm up late studying. I have had to modify my food intake since I was diagnosed with gastroesophogial reflux disorder over a year ago--less caffeine, chcolate, fats, or eating lateto reverse the ulceration I had. I've been a vegetarian for 16 years now and that has certainly hage a profound impact on the way I eat. Luckily, I have grown up in a family that is very health concious and we are able to afford healthy fresh foods. I'm not sure we have any true ethnic costums that affect the way that I eat... we're Irish and scottish but don't eat any more beer and potatoes than the next person :) and definitely no haggis!!
100	@116 - great! Sister is vegan or vegetarian?
116	vegetarian...she loves cheese!
103	physiological - my cousin has gout so he is VERY conscious about what he eatsmeal size- kbbq yesterday with 5 guys. i wasnt about to eat until i passed out like everyone else.composition - my sister refuses to eat anything that doesn't "look" goodearly experiences - sister chocked on a watermelon seed when she was young and hates it nowethnic customs - i have rice with every meal!health concerns - dad is borderline high cholesterol so he watches what he eatsadvertising - i don't need starbucks. but that one commercial where it lays out all the senses makes me really want to drink it
100	@102 - GERD - sorry to hear that. Sounds like you've been able to deal pretty well.
114	Psysiological-vegan friends and vegetarian brother. Meal size-super sized anythingComposition-Early experiences-childhood sit down family dinnersEthnics customs-traveling in Uganda...let's just say-meat on a stick. Health concerns-alcohol. Advertising-high fructose corn syrup ads (pro or con) Social class-the availability of good, fresh grocery stores in less affluent areas. Economics-living in nyc where really delicious food can be cheap-like vendorsor super expensive-like any of Mario battalios restaurants.
102	Yeah, it's been fine now that I understand it. Omeporazole is my new best friend!
100	@103- Starbucks and McDonald's got the advertisements and BRAND down!
100	@114How long in Uganda? What types of meat?

Note. All above prompts are text interactions only. The instructor prompts are shaded and shown as ID#100.

In promoting *intellectual* development during online synchronous chats, Burnett (2003) suggested the adoption of Edwards' (1992) work to promote the modeling of *learning talk* a form of externally directed thought that includes asking questions, making declarations, and offering suppositions. The difficulty in ascertaining this form of

communication and thought was defined as the use of syntax or punctuation to convey additional or non-traditional, inferred meaning. A couple of examples to demonstrate this would include the instructor posting: "Android = apple = male pattern," and "you are the marketer…" In the first instance, the punctuation is likely to be clearly understood by all, but still represents an intellectual task of summary in a form that is entirely unique to the informal written world. In the latter example, the use of the periods would take the place of a non-verbal body language motion or a vocal inflection often used in face-to-face communication that is simple not possible online. Here, the use of the periods denotes both a statement of further though and uncertainty, but also the organizational prompt for students to continue to address this topic. Besides the constant quizzing and hypothetical questioning that instructors can use to facilitate discussion, instructors can model thinking talk through a statement such as the following which was aimed at concluding a class discussion about what factors determine our behaviors with food: "So- our diet is a multifactorial product of envinroment, health, upringing etc.?" Whether or not the instructor knew the answer to this question is not relevant, but what it is relevant is that self-questioning in a summative form does require some level of initial uncertainty that would promote confirmation through review. A final example as to modeling the linking of thoughts to personal experience, comes from this orally delivered excerpt from the transcripts:

> That's an interesting point. I wanted to bring out. I want to confirm can you hear me? When you bring out (laugh) eye level for the person – the adult but you also say eye level for the children a lot of times those child products you know anything in color or cartoonish or high sugary aspects tend to be ones a shelf

down from the adults because they are the eye level of the kid. And anybody can see anyone ever see those kids in the grocery store whining and complaining begging their parents for a particular food item and most of the time the parents tend to cave and I know they did with me. Does that sound familiar anybody?"

In this instance, the instructor is paring the current discussion about food placement in the supermarket and relating this to a personal experience from childhood. The thoughts being displayed by the instructor then are turned back to the students for comments in order to gauge the value of this impromptu thought.

Statistical analysis. All quantitative assessment was analyzed using SASW for Mac version 18.0 (IBM; New York, NY) performed with an alpha level set at $p < 0.05$ for statistical significance. Subsequent post hoc analysis was performed following preliminary significance findings in all analyses.

Frequencies and words counts. All class sessions were placed in a single worksheet in an Excel spreadsheet. The total interactions for each summer session were summed with the subtotal function. Upon each filtering step, the subtotal of full interactions were transferred to a word processor (Word version 14.2.4; Microsoft; Redmond Way, WA) and word counts were assessed per student, per class, and per every five-minute segment of each class.

Interaction timelines. Separating every class session transcript into five-minute increments created timelines for class activity and counting both the number of interactions and the words exchanged during these times. Prior to the scheduled start

time of every class, informal conversations occurred with students in a manner similar to that which would occur in a F2F classroom. These interactions occurred as early as seven minutes before the onset of class. For simplicity, despite these sometimes occurring outside a five-minute block of time, these interactions were all collapsed into a single category called pre-class. Likewise, at the conclusion of the scheduled class period, multiple students remained online in order to consult the professor about class logistics or solicit personal nutrition advice. These conversations lasted in some cases 20 minutes after the end of class but are retained in the class recordings. Because the class dismissals occurred at inconsistent time points, separating these official class from after-class interactions was challenging. Therefore, for descriptive purposes, the timeline of interactions and words exchanged after 90 minutes were kept in five-minute blocks and presented accordingly.

Audiovisual analysis. During a class, there are times where only the chat is used resulting in an AV-free media. At other times, use of the microphone, video camera, screen-share, and on screen images is used for different learning activities. In order to determine the effect of the audiovisual influence on interaction behavior, the transcripts were also tabulated for frequencies of the dependent variables of chat behavior defined on a per class basis for (a) mean total interactions, (b) mean total text interactions, (c) mean total oral interactions, (d) mean total words exchanged, (e) mean total text words exchanged, (f) mean total oral words exchanged. The AV categories were reduced to either (a) chat only or (b) AV enhanced. These were analyzed with a 2 x 6 (AV condition x interaction behavior) analysis of variance (ANOVA) to determine differences in chat

behavior with potential multimodal influence. Homogeneity of variance was determined with Levene's test while normality was examined with Kolmogorov-Smirnov's test.

Coding reliability. In short, following a joint session of coding scheme familiarity, where the author and the research assistant navigated a few lines of code and discussed the major differences of superficial vs. meaningful, student engagement, and facilitator prompt a single class session representing approximately 5% of the overall data was selected for individualized coding. A value of greater than 80% agreement between coders was pre-determined to be sufficient to permit full analysis. Both parties then coded this session in its entirety and Cohen's kappa statistic (Carletta, 1996) was determined for inter-tester reliability for the total of all categories as well as the individual groupings (type of interaction, engagement, facilitator prompt). From previous literature, it was determined that kappa values of 0.40 to 0.6 would be fair, 0.60-0.75 to be considered good, and 0.75 an up were to be considered excellent (Bakeman & Gottman, 1997). Kappa was used because it takes into account the random chance of agreement between two coders. For this reason for large data sets with a moderate number of codes, it is preferred to simple percentage agreement (Carletta, 1996). Following the reliability testing, both coders conferred for areas of consistent disagreement. Clarifications were made and rule interpretations were agreed upon for future purposes. The research assistant then updated this mutually coded session with the new clarifications and then proceeded with the comprehensive analysis without further consultation. Only the updated version was used in the final analysis.

Relationship of facilitator prompt and student engagement. The transcripts were compiled quantitatively on a per class basis via frequency tabulations of the five student engagement categories and the three instructor prompt categories. Multiple Pearson correlations were performed to determine which of the engagement categories were more likely to be associated with specific instructor actions, and which subcategory of instructor action was more likely to be associated with a given category of student engagement.

Relationship of student engagement and class performance. To determine the effect on student engagement on student performance, a multiple least-squares regression was performed on each student's tabulated engagement and correlated to his or her class performance. The predictor (independent) variables of student engagement (academic challenge, student-student interaction, student-faculty interaction, enriching experience, and supportive environment) were used to determine their respective degree of prediction of class performance. Two regressions were performed, one as a predictor of exam performance and the other as a predictor of overall class grade as a percentage.

Interaction behavior and class performance. In order to determine whether interaction behavior was related to final exam score or overall class percentage, multiple Pearson correlations were performed between the following variables: (a) overall exam percentage, (b) overall class percentage, (c) total interactions, (d) total text interactions, (e) total oral interactions, (f) total words exchanged, (g) total text words exchanged, (h) total oral words exchanged, (i) classes attended, (j) mean interactions per class, (k) mean text interactions per class, (l) mean oral interactions per class, (m) mean words

exchanged per class, (n) mean text words exchanged per class, (o) mean oral words exchanged per class, and (p) words per interaction.

Student perception of engagement. Questionnaire responses assessing level of agreement were converted from categorical to numeric values accordingly: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree. Summer session specific and total means were then calculated.

Ethical Considerations

This project completed an analysis of pre-existing data gathered through normal instructional practice during the delivery of two original online offerings in the summer of 2011. Because these courses marked a substantial departure from normal instructional practice at LMU, at extensive student collection of student feedback was solicited in order to collect data for the justification of future online deliveries and improvement in courses of this nature. Internal LMU funding was provided in the development of unique instructionally strategies for these courses. One grant was for the development of mobile phone food journaling software that would be used as a reflective and cultural awareness of the diversity of food in society. The second grant was to develop an extensive food image database to serve as a reference library in the development of portion size and caloric estimations. Both of these funding entities required summative data for submission at the conclusion of the funding cycle, which necessitated the delivery of student questionnaires, used in this study. Additional items that were analyzed for this investigation were included for convenience and for the evolution of educational practices in these courses.

Because this study took place on data collected through on-campus activities at LMU for the partial completion of requirements for the degree of Doctor of Education at Pepperdine University, approval from both Institutional Review Boards for the Protection of Human Subjects was obtained. These applications were granted exempt status under the 45 CFR 46.101(b) 1-6 which provides that research on human subjects may be exempt from full IRB review provided that the data represented:

> 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 subjects cannot be identified, directly or through identifiers linked to the subjects. (Loyola Marymount University, 2012, p. 3)

Further, these data were collected during "established [and] commonly accepted educational settings, involving normal educational practices, such as (i) research on regular and special instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods" (Loyola Marymount University, 2012, p. 3).

While the transcripts and recordings did not contain any sensitive or confidential information that might pose a threat to the safety or security of participants, the synchronous transcripts did contain video and textual information indicating student identification. Only the principle investigator had access to these transcripts and recordings. However, in the analysis, the principle investigator had the voluntary support of one research assistant. Both the principle investigator and the research assistant

completed a federal training session as provided by the national government training institutes (for the completion certificate of the principle investigator, see Appendix D; for the research assistant see Appendix E). During the coding process, all identifying items were removed as tabulations were created regarding code counts and when quotes were transferred to a spreadsheet document (Excel version 14.1.4; Microsoft; Redmond Way, WA). At this point, all participants received a permanent study identification number in random fashion in order to keep the participant specific data separate for calculation of means and correlations to class performance. The data files were kept in the locked office of the principle investigator on campus at LMU. The subsequent write-up and all future manuscripts will utilize the research ID numbers when addressing specific student quotes or student-specific information.

Limitations

Reliability. A qualified and trained research assistant performed the qualitative analysis. The principle investigator however, generated a training codebook based on examples from the transcribed class sessions. The principle investigator then completed a training session with the research assistant at which point, inter-tester reliability was addressed through a correlational analysis of a 5% sample of the qualitative data with a minimum threshold of 80% coding agreement and a high Cohen's kappa (> 0.75) required to complete the analysis. Five areas of interest were identified in engagement including a) level of academic challenge, b) active and collaborative learning, c) student interaction with faculty members, d) enriching educational experiences, and e) supportive campus environments with a total of three categories of facilitator action including: a) social, b) organizational, and c) intellectual.

Validity.

Internal. According to the Campbell et al. (1963), there are eight threats to internal validity including (a) history, (b) maturation, (c) testing, (d) instrumentation, (e) statistical regression, (f) selection bias, (g) experimental mortality, and (h) selection-maturation interactions where each was addressed in turn. This project occurred over a series of weekly time points and was similar for each participant. The short timeframe and retrospective component of this pre-existing data minimize *historical* impacts as no major events were brought to the attention of the instructor during the summer classes. The synchronous sessions were however supported through two different Internet based software packages. The first summer session used Adobe Connect™ and the second made use of Webex™. This decision occurred as LMU was participating in numerous pilot programs with the purpose of identifying a synchronous virtual class product for campus-wide license adoption. It is possible that differential systematic effects might have occurred between the two sets of data as a result of these two different software packages. *Maturation* is possible over the six-week duration of the courses, although students were similarly aged at the time of data collection. Furthermore, while there are expected changes during a course of instruction in knowledge, personal experience, and application of nutritional principles, all participants were exposed to these at the same time, which controls for differential maturation during the study. There were no *testing* items to be included per se. To minimize validity issues with *instrumentation*, the major criteria codes were predetermined and did change through the coding process and the same person (research assistant) completed all coding. The possibility for emergent codes was considered and multiple consistent threads appeared. However, these dealt

mostly with clarifications of the major categories and thus no additional split was required in this analysis. Overall student performance was collected through final grades and final exam scores, collected at the same time point for all participant cohorts, and were constant throughout. All participants were self-selected into this study as result of enrollment which influences *selection* bias of the participants. No reasons are know for this action of the students. One challenge to *mortality* (or drop-out) is that each class session might experience drops or withdrawals from the original analysis. However, the end of semester questionnaire data was only available for those concluding the class, as earlier dropouts did not complete these forms. In total, three participants were dropped from the analysis because they attended as little as one of the class sessions and then dropped or withdrew from the course and thus never completed the final exam or received a grade in the course. All participant data was counted in the transcripts whether or not the student completes the class. Because these classes represent a social-learning community, *selection-maturation* does present a challenge where the participants likely experienced changes over the duration of the course as a result of interactions inherent in the class sessions. However, to some point this is unavoidable and actually encouraged from an educational standpoint where we would promote interactive dialogue in the promotion of individual nutritional application. In total the areas of most concern for this proposal are selection, maturation, and mortality.

External. The four threats to external validity (Campbell & Stanley, 1963): (a) reactive or interactive effects of testing, (b) interaction of selection bias and the experimental treatment, (c) reactive effects of the experimental arrangement (ecological validity), and (d) multiple treatment interface are addressed next. With no *testing* per se

with the qualitative date, the test-retest improvements over time are negligible. However, because each class session is in effect representing research data, we expected differences from the first session to the last for each cohort. These were likely shown in level of socialization with peers, willingness to participate, and comfort with the synchronous sessions. The final exam and final grades were assessed only once and represent no interaction pre-testing on internal validity. *Selection bias* in this study does influence the generalizability of this study. Because we included participant data over time, those who exhibited attrition became a larger proportion of the data samples over time. Further, these students were likely those most engaged in the educational practice, so this possibly limits our generalizability to students in similar situations who actually complete courses. Because this data was collected for and during normal educational practice, there is a minimal internal threat to *experimental conditions*. At no time during the instruction of these courses was the concept of *research arrangement* neither mentioned nor identified until after the course had concluded. It is therefore not possible for student to have behaved differently under the metaphorical microscope, as this condition did not exist at the time of data collection. In this form of action-research where we attempted to measure student engagement in a real-life educational setting, it is very difficult if not impossible to provide for a tightly controlled, double, blinded, placebo style of mechanistic research. *Multiple treatment interference* therefore needs to be addressed. As with most online educational deliveries, there were activities than the synchronous sessions during the semester. A number of additional assignments, activities, both synchronous and asynchronous were required that would collectively contribute to student learning. However, this is no different than what would be expected in normal

educational contexts both online and F2F. Therefore, while the maturation of participants over time might have been influenced by these numerous factors and not just the synchronous virtual class session, this might actually increases our generalizability to other education applications by being a more realistic approach to education. The synchronous sessions were supported through two different Internet based software packages and as such might limit the ability to generalize to the litany of other synchronous software tools. The generalizability of our findings therefore is likely to be compromised by dropouts, but enhanced by real life applications.

Delimitations

We have chosen to examine only the presence of engagement and instructor prompts during synchronous activities with our transcripts and therefore we are not able to comment as to the presence of engagement instructor prompts with asynchronous tools. This study is a descriptive study that sets out to determine the level of student engagement and instructor prompts *during* synchronous events and did not serve to provide insight into comparisons to F2F instruction. With no intervention of control group, the scope of this project was not able to determine preferred or most effective method, only whether synchronous is a singular method capable of engaging students. This study further did not test specific methodological aspects of synchronous instruction such as leading questions, scaffolding, forced collaborative groups, lead-ins, rhetorical questions, and feedback for effectiveness of any method over another.

Summary

This investigation sought to examine what extent evidence of student engagement exists during synchronous online instruction and what relationship the instructor's actions have on student engagement. By including a mixed methods approach with both objective, researcher-derived data and subjective, student-derived data, we established a triangulation of evidence that describes further engagement and facilitator behavior with synchronous online instructional practices. Objective performance based data was also integrated to determine the relationship between student specific outcome and the transcript evidence of engagement. In total, the findings of this study give further insight as to the efficacy of synchronous online instructional practices. Recommendations for future research are provided and speculative contributions are be made to the continuously evolving set of best practices for synchronous online instruction.

Chapter 4 –Results and Analysis

The purpose of this dissertation was to perform a mixed-method investigation into the relationships between instructor prompt and student engagement in five areas based on the Seven Principles of Good Practices in Undergraduate Education using recorded chat, video, and audio transcripts of two fully online nutrition courses. This analysis of data collected during the summer of 2011 was performed during the latter half of 2012. In pursuit of this this purpose, we set to answer the following five research questions:

1. What are the frequencies and types of student engagement in online synchronous chat transcripts?
2. What are the frequencies and types of instructor prompt in online synchronous chat transcripts?
3. What is the relationship between instructor prompt and student engagement in online synchronous chat transcripts?
4. What is the relationship between student engagement in both final exam and overall class performance?
5. What is the relationship between instructor prompt and student engagement according to student perception?

Following a brief descriptive section on the interactions quantified and examined during the synchronous online class sessions, the results for each of the above research questions will be provided in turn. At numerous times throughout the remainder of this investigation, direct quotations will be given from class or student data. These quotations are provided as originally drafted and therefore display frequent spelling and grammar

mistakes. They were left alone to best represent the authentic nature of synchronous text only communication.

Interactions

The summated interactions and number of words exchanged are presented in Table 2. In total, text communication was the dominant frequency of interaction with an occurrence of 8.7 textual interactions to every oral interaction. Despite this lower occurrence, the oral form of interaction yielded more total words exchanged. This was the result of 72 words being exchanged for every oral interaction compared to 6 for every text interaction with a combined mean number of almost 13 words per interaction. This is not far from the value shown by Lobel, Neubauer, and Swedburg (2002) in a random one-hour sample of synchronous chats where the authors found 22 words per interaction. There were 8.4% more words spoken in the second session even though the two sessions were the same duration, included the same number of class sessions, and had fewer participants complete the course (n=18 vs. n=13). The number of words exchanged in oral versus text form was reversed between the two sessions with more words exchanged via text format in Summer Session I. In total, 13% of the overall interactions were student-student in nature, leaving the vast majority (87%) of the student interactions being directed from the student towards the instructor. The data showing the intended audience and direction of interactions is shown in Table 2.

Table 2

Frequency and Word Counts of Both Class Sessions and Comprehensive Totals

	Summer Session I		**Summer Session II**		**Combined**	
	Number of Interactions	Words Exchanged	Number of Interactions	Words Exchanged	Number of Interactions	Words Exchanged
Oral	468	36,125	906	62,626	1,374	98,750
Text	6,481	46,563	5,539	27,067	12,020	73,630
Total	**6,949**	**82,688**	**6,445**	**89,693**	**13,394**	**172,380**

Note. Summer Session I refers to the first semester of class, with Summer Session II referring to the repeat course offered immediately after Summer Session I. Combined refers to the sum of the results from both sessions. Word exchanged is the sum total of words spoken through the entire session. Oral are those that were spoken using the auditory function of the class software. Text refers to the chat type of interaction. This data includes the combined total of all data for the two courses including the five examination sessions and two partial recordings.

Table 3

Summative Nature and Direction of Interaction Per Student and Total

	Interaction Per Student (mean ± SD)	Interaction All-Class Total
Student-Student	40 ± 26	1,230
Student-Faculty	257 ± 114	7,978
Superficial	164 ± 79	5,068
% Superficial	N/A	54.3 ± 6.2

Note. The data above is taken as the sum of interactions over the courses. Student-student interactions are those that were identified as being directed specifically at one or more students and not including the faculty instructor. Student-faculty are those determined to be directed at the faculty instructor such as in asking a question or responding directly to the faculty instructor. Superficial are interactions from the students where there were no coded engagements.

Interactions Timelines.

Figure 1. Timeline of interactions for students and instructor by type of interaction. Student interactions outnumbered those of the instructor at virtually all time points. Text interactions were more frequently used by the students and instructor at all time points. The example above was broken down into increments of five minutes and the types or interactions were summed for all class sessions. All dependent data are presented as the sum total number of interactions for all class periods. Only the normal non-exam sessions of a complete, non-partial nature were included in this figure in order to best represent the normal flow of communication. The class was intended to run 90 minutes, but many went up to five minutes late. This chart includes all additional communication via webconferencing tools that were captured in recordings and some resulting in interactions lasting until 110 minutes. Pre-class includes all interactions prior to the intended start time of class. The solid lines are both total numbers of interactions, the dashed lines are text chat only, and the dotted lines are oral interactions only.

Figure 1 depicts the timeline and flow of interactions across a normal class period. For clarity and accuracy, the exam proctoring sessions and any incomplete sessions were removed from this analysis and the data presented are the mean interactions for all participants across all class periods. After initial high frequency periods in both student and faculty posts, the instructor posts declined by minute 15 and remained steady for the

duration of the average class period. It also appeared that oral frequency of interaction peaked between 15 and 45 minutes into the class. The rate of instructor interaction was approximately half the rate of the student total throughout. The maximum rate of interaction was highest for students in the 85th minute where they registered a combined total of 600 posts whereas the highest rate for the instructor was in the 5th minute with a total of 278 interactions.

Figure 2 depicts the timeline and flow of total words exchanged across a normal class period. In order to provide a visual for the normal instructional class sessions, the exam proctoring sessions and any incomplete sessions were removed from this analysis and the data presented are the sum of all words across all class periods. The highest instructor activity occurred towards the beginning and ending of the class periods with total words exchanged at these times of 7,090 and 6,660 respectively. After initial high word volumes from the instructor in the first 20 minutes of class, the student words exchanged increased steadily until peaking during the 25th minute at 5,310 words. Also occurring at the 25th minute was a reversal where the students exchanged more words in total than the professor. This finding of students' words outpacing those of the instructor was unique to the 25th minute. The number of words exchanged by the instructor via text chat remained relatively steady throughout while the student word totals increased towards the latter portions of class and peaking during the 70th minute.

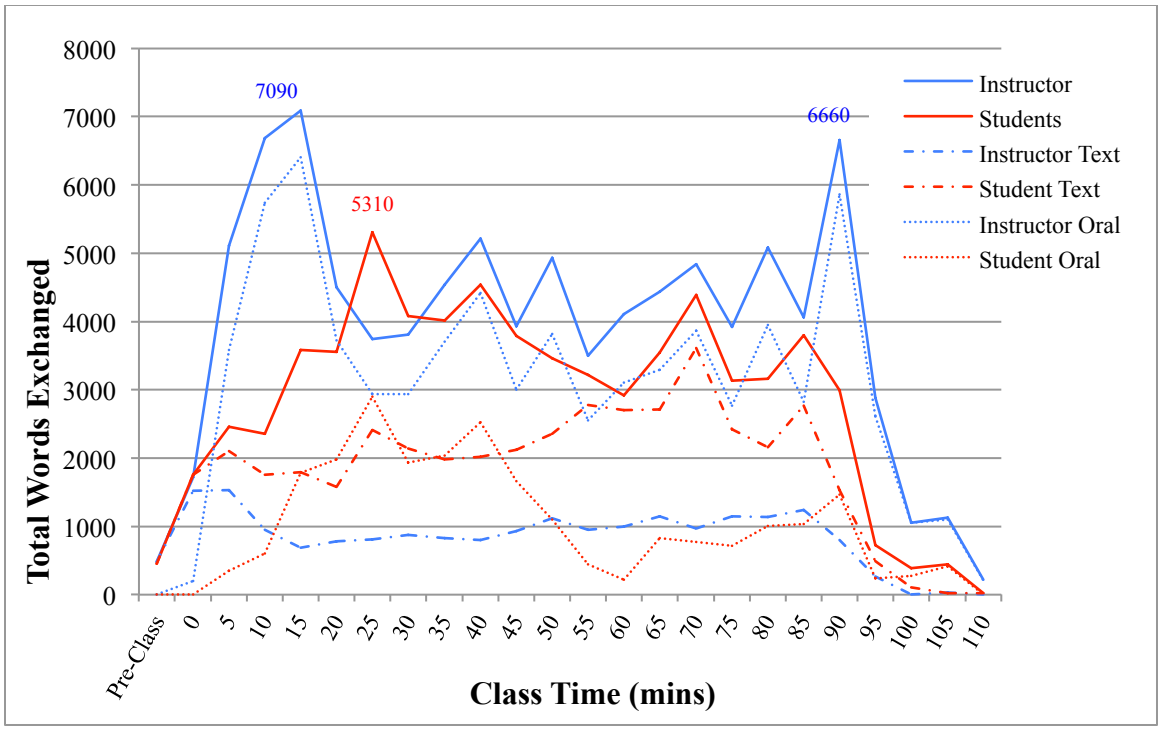

Figure 2. Timeline of words exchanged for students and instructor by type of interaction. Students contributed roughly equal words during the middle of the class session. The instructor provided more words at the beginning and conclusion of the class. The oral form of communication provided the majority of words for the instructor whereas students contributed more words at most time points via text. The class was broken down into increments of five minutes and the total number of words exchanged was summed for each class session. All dependent data are presented as the sum total number of words for all class periods. Only the normal non-exam sessions of a complete, non-partial nature were included in this figure in order to best represent the normal flow of communication. The class was intended to run 90 minutes, but many went up to five minutes late. This chart includes all additional communication via webconferencing tools that were captured in recordings and some resulting in interactions lasting until 110 minutes. Pre-class includes all interactions prior to the intended start time of class. The solid lines are both total numbers of interactions, the dashed lines are text chat only, and the dotted lines are oral interactions only.

The number, type, and timing of interactions in this dataset reveals that online, synchronous class sessions can provide a framework of realtime communication between faculty and students in an academic setting. In combination, these two summer session nutrition classes generated close to 14,000 interactions and 172,000 words exchanged. When examined further according to the number and length of classes, this represents a

rate of 3.5 to 8 interactions each minute when instructor and student aggregates are considered. Our data showing 28 messages per minute at peak are inline with previous work showing peak rates of exchange of 15-20 per minute (Lobel, et al., 2002). If referenced on the basis of word count, the rate of communicative exchange still ranged from to 65 to 106 words per minute. Even when examined on a per student basis, the rate of exchange is high. Evidence to this conclusion is that during the course of five, 90-minute class sessions, each student averaged 40 interactions per class of which 13.4% of these were directed at peers and the remainder being directed at the faculty instructor. These findings are much higher than previous research that found students averaged 10 posts per hour during a live session lasting three hours (Lobel, et al., 2002).

The higher words contributed by the instructor at the beginnings of the class sessions suggests greater reliance on the instructor to initiate discussion, introduce topics, and provide instructions. Student contributions then elevated through the middle sections and plateaued to meet the exchange volume of the instructor. At the conclusion of the classes, the instructor once again became proportionately more involved most likely in order to summarize the days' discussions, conclude the activities, and provide further instructions on upcoming class and assignment logistics. The increased rate of instructor involvement was intended during the development of the class sessions in order to offset the findings of Markman (2009) who demonstrated difficulty in moving into and out of virtual meetings. When left to the student participants, challenges arise such as distractions and disruptions that required repetition in getting the group back on task (Markman, 2009). Greater instructor control at these critical stages might be necessary or at least promote a greater efficiency of time during transitions in live class sessions.

Audiovisual Analysis.

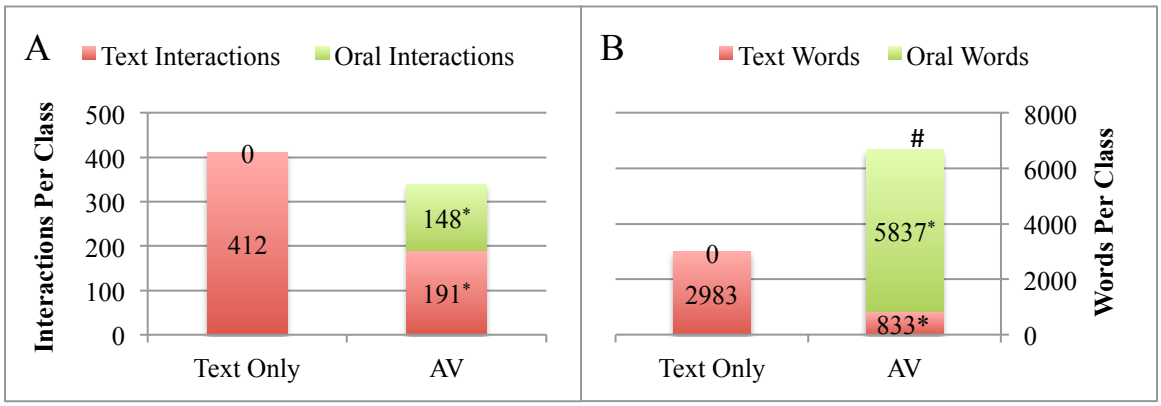

Figure 3. Mean total per class interactions (A) and words exchanged (B) under differing AV conditions. The number of text interaction was shown to decrease when some form of concurrent media was used. Also, the number of words exchanged was shown to be higher during concurrent media use. All above data are total class means per class session. Only the normal non-exam sessions of a complete, non-partial nature were included in this figure in order to best represent the normal flow of communication. The class was intended to run 90 minutes, but many went up to five minutes late. This chart includes all additional communication via webconferencing tools that were captured in recordings and some resulting in interactions lasting until 110 minutes. The text only category refers to the times when no audiovisual functions were enabled during class sessions. AV refers to at least one form of audio or visual function that was enabled and might include audio during chats, screen sharing, camera, or shared images. *Denotes statistically different from the Text Only condition ($p < 0.005$). #Denotes that the total words exchanged in AV (oral and text) were statistically different from the Text Only Condition ($p < 0.001$).

The original dataset allowed for each interaction to further be classified as occurring during differing audiovisual situations. The data has been collapsed across the original seven categories in order to yield those interactions that occurred during chat-only activities and those that occurred during all forms of AV supported activities. These AV supported sessions included times when any participant was speaking or appearing in the video window. The mean number of interactions was found to be 17% lower during any AV condition than text only although this was not statistically significant ($p = 0.583$) possibly due to large variances in each variable (means ± SD; 411 ± 212 versus 339 ±

268). There were however significantly fewer text interactions (53%) despite significantly more oral interactions during these conditions. The interaction description during AV condition data is represented in Figure 3. Here, it is also shown that despite continued large variances (2,983 ± 1,803 versus 6,670 ± 3,466), the number of words exchanged during the combined AV conditions is 124% greater than when the text window alone is being used. This is explained through a significantly lower (72%) word count via text interaction and concurrently higher number of oral words exchanged.

Engagement, Prompt Coding

The interaction rates of these class sessions suggests a high rate of communicative exchange, but frequency does not necessarily equate to quality and thus we set out to determine the frequency of meaningful interactions during synchronous online class sessions. In identifying *meaningful*, we used five categories of engagement from the NSSE whereby every single interaction over the course of 35 hours of recorded class time was quantified to determine whether the interaction was superfluous or of sufficient depth to meet the criteria of at least one category of engagement (National Survey for Student Engagement, 2011).

Reliability. In total, the reliability check demonstrated a 90% agreement that included the agreements on positive (4,183) and negative (481) codes across all of the code categories (n=11). The reliability data are presented in Table 4. The total Kappa of 0.91 coupled with excellent Kappa in all subcategories resulting from the first reliability check met the pre-determined threshold set out in the proposal and no further reliability checks were completed.

Table 4

Summary of Data from Inter-Tester Reliability Analysis

	Interaction Type	Engagement	Instructor Prompt	Total
Total Disagree	196	208	77	481
Total Agree	1,168	2,272	743	4,183
Percent Agreement	86	92	91	90
Kappa	0.81	0.91	0.89	0.95

Note. Interaction type refers whether the interaction was (a) superficial, (b) student-student, or (c) student-faculty. Engagement is (a) academic challenge, (b) active and collaborative learning, (c) faculty interaction, (d) enriching educational experiences, (e) supportive environments. Instructor prompt is either (a) social, (b) organizational, or (c) intellectual. The Kappa statistic (Carletta, 1996) is calculated as: k= [(Pr(a) – Pr(e)] / [1- Pr(e)] or [(probability of agreement between coders) – probability of random agreement)] / (1 – probability of random agreement). Percent values are given as a percentage. Total disagreement is the number of times coders disagreed either with one identifying a code and the other not or the reverse. Total agreement is the number of times both coders agreed either in favor or opposed to a code.

Engagement Frequency. Of the total student interactions, approximately half were considered superficial (54%) with the remainder representing evidence on the spectrum of categorical student engagements. This resulted in 8,906 coded engagements that averaged 356 engagements per class across all sessions including examination sessions. When only class sessions were accounted for by neglecting exam proctoring sessions, the mean number of engagements per class rises to 445 engagements per class. On a per student basis, the mean engagement total across all categories was equal to 289. The most frequent engagements were (in order of decreasing frequency) active and collaborative learning, faculty interactions, enriching educational experiences, academic challenge, and supportive campus environments. With the exception of supportive

campus environments where seven students did not record a single instance of engagement, all students registered at least one instance of each other type of engagement. Engagement frequencies across all class sessions and per student totals are shown in Table 5.

Table 5

Type or Engagements Per Student and All Class Totals

	Engagements Per Student (mean ± SD)	**All-Class Total**
Academic Challenge	12 ± 8	364
Active and Collaborative Learning	134 ± 55	4,139
Faculty Interaction	125 ± 51	3,870
Enriching Educational Experiences	16 ± 12	480
Supportive Campus Environment	2 ± 2	53

Note. Engagements per student represents the total number of engagements divided by the number of students finishing the class for a grade.

When only the engagements were examined further, the analysis revealed 134 active collaborative learning engagements per student and 125 instances of faculty interactions per student over the course of their class experience. While these were the most numerous categories of engagement represented, each student on average demonstrated an additional 16 instances of enriching educational experiences, and 12 instances of academic challenge. Lastly, while representing the least common engagement, a supportive campus environment was evidenced at least once by all but seven students, which is a number equating to 77% of the study sample that gave evidence of this engagement.

Academic challenge was frequently displayed when students explicitly shared that they were having difficulty as in this text interaction "oh gosh that's a hard question." But more commonly, it was also seen in instances when students were seeking clarifications of things that they thought they had understood previous to our class discussion and were now expressing uncertainty. For example, during a conversation about the difference between causal and correlational relationships, one student offered this textual interaction "what about chain effects? just because something does not directly cause another thing doesn't mean it isn't he cause." Here, again we see that the student is questioning the instructor in order to gain clarity on an item that had just been addressed and the student at this point was still unclear on.

Students evidenced academic challenges from the questionnaire where occasionally, student feelings of the usefulness of the synchronous class sessions suggested negative emotive affect. When this occurred, it was in one of two areas. The first was that the material "was just too dense to fully understand in 6 weeks," a factor much more in line with condensed summer science curriculum and thus unlikely to be dependent on the chosen online tool. The second was that "there was a disconnect between what was discussed in the class sessions and the context from the text," which is an item that also might not be directly attributable to the synchronous sessions as much as the style of the instructor.

Students displayed high levels of the very broadly defined *active and collaborative* engagement. As in the nature of our coding, anything that was deemed to not be superficial therefore became at least an active form of engagement. This is rationalized because when in the case a student offered documented evidence of a class

contribution (judgment, answer, clarification, etc.) they were unquestionably participating in an active way to the class proceedings. However, at times, as would be difficult in face-to-face interactions, the students were able to directly ask each other questions without necessitating an interruption in the flow of class discussion as exemplified by this text exchange "did everybody else find it confusing?" which was following immediately be a response of "ya, it was a little confusing." In fact, the back and forth between these two students took place in a parallel conversation in an open, back-channel (Bry, Gehlen-Baum, & Pohl, 2011; Cogdill, Fanderclai, Kilborn, & Williams, 2001) of the session during a time when the instructor was orally explaining some of the processes behind a recently submitted diet analysis assignment.

From the post-class student questionnaires we learn that synchronous "interaction is very realistic, and I felt that I was actively participating. The topics generated in the chat box made us think…other questions that rose from my classmates also helped me achieve a lot of knowledge in this course." Active in comparison to collaborative, anecdotally was the most commonly identified criteria in this combined engagement category. Although not directly linked, this is plausibly supported by the fact that faculty directed interactions did outpace the student-student directed interactions by a 6.4 to 1 ratio. One final piece of student generated data reflecting the interaction between colleagues was "I feel that I communicated more with other students in this class than I usually do in regular class, which is amazing!"

Faculty interactions were extremely common in this set of data produced from these coding criteria and faculty interactions were the second most common engagement code tabulated. Faculty interactions were evidenced in the transcripts during class

activities, to share private information, and to solicit logistical help with academic mattersAs just revealed, a large majority of the interactions were directed towards the instructor. The most common of these occurred when students were directly responding to questions or directives prompted by the instructor. The second most common were questions offered by the students to the instructor in seeking clarification of the content directly or as to how the content related to their particular life circumstance. Interesting examples of deeper faculty interaction were shown when students were engaged with (a) mostly one-to-one discussions about personal exercise or nutritional prescriptions (b) after class discussions about classroom performance and (c) back-channel side chats anonymous to the other students in class.

Table 6

Faculty-Student Interaction Engagement Transcript Example

Interaction Type	ID#	Interaction
oral	129	Ok. So, my question dealt with uhm lifting weights versus doing cardio work. Which one burns more fat? I heard that lifting weights burns more fat. Because, you're lifting weights causes your body to keep burning fat after you stop lifting weights. So it continues to burn more calories.
text	100	Resistance training more effective than cardio for fat loss?
text	100	difference between fat loss and calories....
oral	100	Alright. So what do we have to say about that? She's – is that right? If your goal was- if someone was interested in fat loss, which would be better? Cardio or resistance training? Is that what you're asking?
oral	129	Yeah.
oral	100	What do you folks think? Is one better than the other?
text	126	both together!
text	130	lifting weights because it boosts your metabolism more after your workout?
text	128	i think that more cal are burned but im not sure about fat loss
text	122	the body gains fat while gaining muscle, so in order to lose fat your should do more cardio
text	124	yes, i think cal are burned
oral	129	Yeah, that's what I read. That your metabolism continues to work after you lift weights.

Note. The shaded rows represent faculty interactions (ID# = 100). All other lines of interaction are students.

During one assignment, students were asked to prepare a short audio and video presentation to the class. After initial opening remarks by the student, the instructor and student would continue to converse orally while additional students were encouraged to continue to chat amongst themselves or direct questions to the speakers to help guide the conversation. An example of this sort of exchange is provided below in Table 6. In this example, student #129 is identifying a research question to determine what type of exercise is most helpful for fat loss. The instructor does not answer the question directly, but rather threw the question back to the class in both simultaneous oral and text formats.

Additional faculty-student interactions were captured following each formal class period. After-class discussions were captured on numerous occasions and served the purpose of clarifying grades and class procedures or allowed students to inquire more fully about exercise and nutrition questions relevant to their own unique goals and health concerns. One student inquired to the instructor if it would be appropriate to ask a few questions following the conclusion of class via an email prior to the class session. Then the student issued a reminder to the instructor when concurrent good-byes were being offered for all of the other students. Then the student offered via oral interaction

> "I mean you know we are more than half way through the class. I just want to make sure that I am on track. That I am answering – you know doing the homeworks in the right way. Or the activities – I can see the homework."

The conversation proceeded after that for 10 minutes with both the instructor and student each completing numerous rounds of turn taking mostly in an oral form. These meaningful faculty-student interactions engage the student through individualized time to confirm class progress and seek feedback sufficient to match their respective goals for

learning and performance in the class. Interactions like these are very normal in a traditional F2F class in the minutes immediately following class conclusion or during later office hours. Capitalizing on the recording potential of synchronous media gives us the chance to examine the implications unlike the traditional F2F format.

Back-channel communications are a form of private or side chats intended to allow class participants to converse with one another so that the other members of the class are not made aware of the conversation (Bry, et al., 2011; Cogdill, et al., 2001). These back-channel communications can be both in order to intentionally converse with a specific individual in a manner so as to not interfere with the flow of the conversation or and perhaps more importantly, engage in private and individualized conversation of confidential nature. In one such instance from these class sessions, in the middle of introducing the ensuing text chapters on eating disorders, the instructor was directing students to view short emotive web videos in order to elicit student interest and empathy for those afflicted with these diseases before entering into mechanistic health consequences of these diseases. A student privately delivered in the back-channel to the instructor that she was not comfortable with the conversation and asked to be excused until this portion of the class had been completed. In follow up conversations via Skype, it was revealed that she had previously sought treatment for anorexia. In other instances, private chats were used for students to intimate that they are stepping away to the restroom or that they had not completed an assignment and would ask to be excused from answering questions about their assignment. The benefit of these type of interactions is that relationships can be promoted between the student and faculty member in non-threatening or intimidating ways. Conversations of a personal nature tend to bring out

humanistic and empathetic connections between individuals such that future interactions might be more trusting leading to a higher divulgence of information and personal, translational relevance that might facilitate greater engagement in other categories (Joinson, 2001; 2010; National Survey for Student Engagement, 2000).

In the follow-up questionnaires, no student displayed any level of disagreement with the statement that they had "received adequate interaction with the instructor." One student suggested "positives were that [synchronous class sessions] gave us a chance to get some real face time with the instructor." Another stated that they "liked the classes alot because you got to know everyone's feedback on what we were learning as well as everyone's personal experience in regards to the material being discussed." These data lend evidence to the quality of faculty interaction that can be had through synchronous class sessions where students can feel a sense of contact with a geographically distant person and still receive realtime feedback in their learning process.

Enriching academic experiences are seen in a diverse number of ways but did in fact only result in a small number of total instances compared to active learning and faculty interactions. However, an overall per student rate of 16 instances over 5 class sessions per student was likely to be practically significant. The transcript data mostly gives examples where students were exposed to diversity of experience, culture, and attitudes. In many cases this was seen when students shared about people they knew or circumstance affecting family members. Frequently in this dataset, student-athletes were able to give insight to the diet and training routines for others to appreciate. One student shared her experiences with Crohn's disease and others about diabetes, obesity, and familiar cardiovascular diseases. In another instance, the class was made aware of the

pressures of some industries to uphold an unhealthy physical ideal. The example came from student #111 who shared via text that "I was interning in new york last summer, fashion pr, and the model i was working with told me her agency wants her to drop a few pounds for fashion week" during our discussion on eating disorders. Students were encouraged to identify and then discuss the impact of culture, ethnicity, and religion on food behaviors where one student said in a chat "I was skinnier before i moved to the US... what's skinny in asia is different to what's skinny here i guess?" These multiple examples give insight to the types of diversity exposure and awareness that can be facilitated in online synchronous class sessions where students' perceived anonymity can promote greater self disclosure (Joinson, 2001).

Additional enriching experiences were seen in the ability for these class sessions to promote transformational and translational learning opportunities to students. By giving students a chance to challenge at times their beliefs and current behaviors with food, students showed evidence of changing their lifestyles. One student said in the follow-up "my interest in nutrition and fitness is heightened, so much that I have shared it with my friends, and family" which speaks not only to the transformation in the student, but also the translation to the applied world. During one class session, student #123 was able to tie two broadly different disciplines together during a discussion on the relationship between mortality and obesity where they remarked that there "was a funny point in my critical thinking class about the environmental effects of personal habit and it was suggested that healthy living causes more of a negative environmental effect, because you live longer." All of these examples give clear evidence that students can be exposed to a broad spectrum of diversity, adopt fundamental transformational changes in

their behaviors and attitudes, while also translating academics to personal and environmental situations through instruction mediated via online synchronous class sessions.

The least represented group of engagements, *supportive campus environments* was only evidenced rarely. In total, we coded 53 instances of this engagement across all students and all class sessions, which resulted in a mean per-student number of two engagements. However, as stated previously, the large respective variance here (SD = ± 2) did not allow evidence of this engagement in as many as seven students. The majority of instances occurred due to logistics or the class, technology troubleshooting, and conversations of a non-academic sense. Logistics were often encountered when students were seeking help for outside class meetings or deadline adjustments due to work or other personal commitments. One student inquired as to the possibility of a personal meeting suggesting via text that "since im on campus, can i come into your office for a 1 on 1 meeting or would you prefer it be on skype?" while another student inquired about rescheduling a predetermined meeting time. Technology was a constant issue throughout the class despite 26 out of 28 students responding in some level of agreement with the statement "My knowledge/experience with technology was adequate for performance in a distance learning technology based course." An example from the transcripts of supportive campus environments included student asking about software availability on campus computers, acquisition of the E-book and materials, and Wi-Fi availability. Class logistics were supported with allowance given for missing classes due to holidays, requests for study guides, and live-class surveys on proposed class meeting times.

Concluding remarks about engagement. Instances of engagement are likely more frequent in every category as the methodology used here was not able to identify or observe engagement in a more abstract sense. Because we used only recorded transcriptions from class sessions that had occurred in the past, it was not possible to quantify purely cognitive instances of neither engagement nor those that might have been otherwise observable in visible sense should the coder and students occupy the same physical space. Said one student in the questionnaire

> I suppose a physical class setting would have been beneficial in this sense – I did not always have something to say during the discussions, but it did not mean I was [not] actively participating; yet I feel that I was marked down simply because I was reading along and didn't type instead.

Silence in synchronous communication has been investigated previously (Markman, 2009; Zembylas & Vrasidas, 2007). In one such study, the authors attempted to analyze silence through the absence of chat postings and proposed four possible purposes for silence beyond what could be simplistically and naively be viewed as an absence of participation. Here, they suggested that silence could in fact be the result of (a) non-participation, (b) confusion, (c) marginalization, and (d) reflection (Markman, 2009). The quote from the student above speaks to a certain level of reflection where in fact the student may very well have been engaged, but the assessment methods available to this study were not able to capture it.

A powerful strength of this investigation was the volume of data accumulated over the course of these 25 total classes and exam proctoring sessions. We followed the protocol of the NSSE where only students could provide evidence of engagement, not the

institution as would be seen with survey data. In this spirit, every instance of engagement was produced and tallied through direct examination of student-generated interactions. As per our coding protocol, only student interactions could be counted as engaging. Concurrently, only the instructor interactions could be the source of any of the instructor prompts. The intention of this separation was useful at avoiding occurrences when the professor would talk about academic rigor (for instance) without seeing evidence from the student directly that rigor had in fact been encountered. Should this not have been the case, it would have been very possible to inappropriately elevate the numbers of engagement across all categories. A final note of importance is that unlike the NSSE that assesses student engagement on a summative, retrospective form, our analysis was able to collect evidence of engagement in a formative, realtime format (National Survey for Student Engagement, 2011).

Prompt Frequency. The total frequencies of facilitator prompts are presented in Table 7. In total, there were 4,124 instructor prompts given across the 25 class and exam sessions. In decreasing order, intellectual prompts were the most common (48%) followed by organizational (30%) and social prompts comprising the remainder (22%). Despite large variance across all three prompt categories, there were statistically more intellectual prompts than organizational ($p = 0.013$) or social ($p < 0.001$). However, the difference between the number of social and organizational prompts was not significant ($p = 0.271$).

Table 7

Type of Instructor Prompts Per Class and All Class Totals

	Prompts Per Class (mean ± SD)	**All-Class Total**
Social	36 ± 35	921
Organizational	50 ± 30	1,237
Intellectual	79 ± 52[*#]	1,966
Total	165 ± 88	4,124

Note. Prompts per class represents the mean number of coded prompts per all class and exam sessions. [*]Denotes significantly different than organizational ($p < 0.05$). [#]Denotes significantly different than social ($p < 0.001$).

The facilitator was actively involved in the online class sessions indicated by a mean per class interaction rate of 165. As shown in Figure 1, students contributed close to twice as many prompts as the instructor relatively consistently throughout the class sessions. Because the students outnumbered the instructor in each session by 4-10:1, this is not surprising. However, from Figure 2, we see that the volume of information (as evidenced by the number words) exchanged by the instructor was greater than students at almost all time points. There was further evidence of a bimodal nature of volume with a large number of words coming both at the beginning and end of each class. This is justified in examining previous work showing disorder and inefficiency at the start of synchronous sessions when delegated to the student participants (Zembylas & Vrasidas, 2007). The explanation for our finding suggests that there was a larger use of the first few minute of class time to orally communicate greetings, instructions, and plans. This was repeated towards the end of the class sessions as well where summary and concluding remarks were provided orally to students as well as assignment reminders and additional

instructions about future activities. The fact that students could maintain a high rate of text chats at all times even when the instructor was communicating via oral means, is interesting and might be positive or negative. While others have found similar trends of high student involvement (Johnson, 2006) with synchronous class sessions, it might be negative in that these high rates might place higher cognitive load on students due to multimodal feeds simultaneously (Herring, 1999; Kear, et al., 2011). On the other hand, the parallel potential of communication made possible by synchronous communication might help to facilitate higher engagement through these elevated exchange rates during periods when an oral speaker and textual interactions can occur simultaneously (Lobel, et al., 2002). In part, our high rates of interaction might have resulted from an act of intentionality by the instructor where at multiple times, students were encouraged via text to "be sure to keep up the chats on the side-don't be bashful" even during times of oral delivery of content by the instructor. Another example from the class transcripts had the instructor stating that "the Chat is for everyone at all times!"

Social prompts according to Mason (1991) and Burnett (2003) include those that are intended to promote a safe and supportive environment. Evidence of social prompts was more substantial at the beginning and end of each class where greetings, and small talk perfused the transcripts. Burnett offered three ways in which the instructor might provide a social prompt and the first of these is through *encouraging social interactions*. In one such example, the first few minutes of class revealed that a couple of the students had visited Disneyland over the previous weekend. The ensuing conversation was about Disney trivia, their favorite rides, and the names of the Seven Dwarfs. The instructor directly posed most of these prompts although students were engaged in arguing the

merits of each amusement park ride. The second method was through *affirming and thus encouraging student comments* so as to promote continuation of the demonstrated behavior. During introductions in the first week of the class, one student was discussing their current internship opportunity that had only begun the night before. The student orally stated that the "mission of Dolphin Quest is touch the minds and hearts of all of its guest and educate them about the dolphins and oceans and all that we have on the planet. It's an interaction facility not a show facility." The instructor quickly responded to this interaction via this text "well said" which prompted the student to follow-up with "I've been studying my intern packet (laughing)." This exchange of an entirely social nature had no direct bearing on the content or learning objectives towards nutrition. However, it did offer affirmation to students that for the time being it was not just permissible, but encouraged to continue this social banter. The third method of Burnett's social prompts was through the *use and development of informal language*. Perhaps the most oft used example of this was during the first day of class where the instructor modeled cues such as "@101 - love the athletic diet ;)." In two ways, the instructor pushed informality with this single post. First, the "@" symbol gives the designation of calling on student 101 and thus focusing this comment to specifically one person. In addition, by ending the interaction with an emoticon (i.e. a "winky" denoted with a semicolon and a right parenthesis), the body of the message is bookended with informality and improper grammar, a practice common to synchronous communications. The insinuated effect is that students are also free to interact in this manner such that speed of interaction can be promoted over technically accurate writing in this forum.

Organizational prompts are used to ensure "that students can both access discussions and manage dialogue" (Burnett, 2003, p. 248) and over the course of these 25 class and exam proctoring sessions there were 1,237 instances of instructor interactions coded as organizational with this intent. Burnett (2003) suggested five instances of organizational moves with the first one being *directing* students towards a particular task. One example of directing students occurs in this text interaction where the instructor said, "we are getting down to the end. Last question - is breakfast 'essential?'" At this point, it is clear that an end is being asked of the preceding conversation thread and that a new one is to begin. Further, a specific direction of task has been identified. A second organizational technique is *selecting* where for example the instructor said, "Everyone - let's talk about 122's question." This lets all of the students know what comes next. There is evidence in this transaction that multiple questions and other paths of communication have preceded this selection. The instructor has in this case chosen the one that they should like to pursue further. The third area of Burnett's (2003) organizational prompts is *summarizing and re-directing*. Following a discussion of research methodology and statistical interpretation, the instructor orally offered

> alright, so why am I telling you this? I used an example of height and IQ to talk about correlation and causation, this is a nutrition class. What do you think we are trying to talk about here? Give me some examples that might be coming to mind. What's a brainstorming, what's coming to mind?

The point of the previous conversation was to create the ability of students to distinguish between correlational statistics (where two variables are related) and causation (where one variable causes changes to occur in a second). The instructor then moves the

conversation from one of understanding and comprehension to one where students are asked to apply this to another condition than what they have been previously exposed. This tactic was therefore used organizationally to move students towards a higher cognitive domain following a summary statement concluding the previous conversation. The fourth prompt technique of the instructor is the use of *summarizing and waiting*. Evidence of this technique was not very numerous in a strict sense. Often, cues were posted directing students to wait a little longer and that they indeed had to keep working when the chat rate had decreased. One example occurred following a section of class where students were completing the third round of watching an Internet video clip and providing emotive reactions or commentary to what they had just viewed. Following a rather somber clip from a film on eating disorders, the instructor noted a lull in the communication pattern and offered that "Ok - this one is hard for some of us. Change of pace coming..." More time was provided and eventually students complete the prompts as originally desired. The purpose of this instructor move served to break the increasingly long period of time that had elapsed without interaction, confirming the difficult subject matter at hand, while also encouraging students to contribute because this exercise was coming to a close soon. *Maintaining multiple strands* occurs frequently in synchronous classes and perhaps is used best following a task where students are given some time to complete a directed task and then report their thinking or findings back to the group. Because the nature of keyboarding produces different rates of composition from one student to the next, the student responses will come up at different times. The instructor can leverage this to follow-up with the first post that is entered, while the other students continue their preliminary responses. This serves to minimize the dead-time

following a quicker student response that might then otherwise become passively involved with the conversation. In the following example, the entire class had just completed a diet analysis assignment and they were asked if they encountered any surprises with their findings. Table 8 shows what occurred after being prompted to share how many calories they each consumed. What we see in this example from Table 8 is that the professor was actively engaging multiple students along different paths of inquiry and follow-up at the same time. This individualizes the attention of each student because they are all answering questions specific to their own assignment and personal health assessment. In a traditional F2F class, this would not have been possible as only one student would have been the center of the conversation at a time and the other students might have been able to refer to their own work but it would have been challenging if not impossible for the instructor to provide this form of direction in five students concurrently. By working with students in parallel conversations (Lobel, et al., 2002), greater individualized attention can be paid to each student without interfering with the engagement of other students.

Table 8

Example of Maintaining Multiple Thread Transcript Example

Interaction Type	ID#	Interaction
text	100	So for 113, 115, and 111 - why so low?
text	115	yep
text	100	For 109 and 101-why so high?
text	113	I was really surprised that my reccomended was WAY higher than I actually ate. I always eat about that amount.
text	109	400 grams of carb!
text	101	i dont know! but the mypyramid said i should be about 2600...so I guess i was close.
text	112	my recommended was 2 times what I had that day!
text	111	I wasn't watching what i ate but i guess i naturally eat a lot of lean meat
text	111	and vegetables
text	100	@ 113 - was this sort of a normal day?
text	115	I have to watch my weight since I am in the entertainment business and my health issues.
text	100	109 - what had so many carbs?
text	100	@101 - are you actuive?
text	100	@111 what kind of meat...lean or fatty?

Note. The shaded rows represent faculty interactions (ID# = 100). All other lines of interaction are students.

Intellectual prompts are the last category of prompts and are suggested to be important in providing meaningful learning opportunities for students (Burnett, 2003). These are the most often used of the four categories of instructor prompts demonstrated in this dataset. The first and most common form of intellectual prompts comes in the form of *leading questions*. In an example from the class transcripts students were being asked to talk about sources of error in any measurement of biology or behavior, where the instructor said via text "In ever measurement, there is some error. These numbers are not expected to be exactly correct. Where are the areas where we might have numbers that are a little 'off?'" This interaction is serving numerous content related purposes but in particular there are elements of both organization and intellectual prompts. Here, there is

a summary, factual statement followed immediately by a request to apply this new knowledge to one's personal life. The attempt to translate the activity is seeking to engage students in the form of an enriching academic experience. A second category of intellectual prompt from Burnett shows that we can *make declarations*. Declaring something to be true whether or not it in fact is can be powerful at promoting student discussions. One student inquired about "raw" diets where, in simplistic terms only things that are not cooked should be consumed. Following a brief exchange, the following was offered by the instructor via text "A lifestyle of raw can be heathier especially because this is a departure from tradiational fatty, meat based diets that are unhealthy." This statement then led to students' additional inquiries about whether these raw diets were any tasty, if they could perhaps be traumatic to the digestive tract, and if there were additional risks of food contamination in eating only foods that have never been heated and therefore never pasteurized. *Suppositions* offer another way that instructors can promote meaningful student interactions and intellectual time with the material. In a discussion about exercise misconceptions amongst the general public, the instructor orally offered, "one of the common held beliefs is- at least amongst people just casually going out and working out is that stretching means a decreased chance of injury across the board." By first setting the table and identifying the premise of conversation, students are now directed to reflect on their thoughts of this concept. The instructor then followed this with "the more that I stretch, the more flexible I am, the less chance I have of getting hurt in general?" By doing this, the instructor has tied currently held beliefs to a second statement of connection whereby if the first were true then the second must also be true. This provides students guiding framework for them to examine their beliefs

before a formal examination of the research literature on the subject is provided. The fourth and final category of intellectual prompts by an instructor is *modeling intellectual processes.* One of the most common ways that this can be demonstrated is necessitated through the innate difference between spoken and online communication where a lack of visual and auditory cues conveying additional layers of meaning to the words being spoken can be hard to overcome. In this case the instructor can use improper grammar or punctuation, emoticons, and ALL CAPS, in order to denote additional contextual meaning. An example of this is provided through the instructor's use of "carbohydrate supercompensation (technical jargon)" where the parenthetical served as an aside of additional information that could have easily been delivered in F2F communication in an uninterrupted manner. Another example occurred when the class was participating in a discussion about what constitutes a good workout and the factors of program design. Students were first asked to identify the best workout in the world and following an exchange of opinions on this question the instructor offered via text "The answer is....dunh dunh duhn....The one that you will do. What do I mean by that?" Here we see the use of periods to identify pausing of time and suspense while offsetting that with an onomatopoeia to simulate musical intervention for entertainment purposes. The multiple intellectual nudges here come to the use of these modeling behaviors in addition to the supposition followed by the directing question.

Relationship of Facilitator Prompt on Student Engagement

Correlational data for all engagement categories and all facilitator prompts are provided in Table 9. Three variables in particular were shown to have correlational coefficients above 0.75 and thus indicating strong relationships. The strongest of these is

the relationship between social prompts and supportive campus environments ($r = 0.79$), followed by intellectual and faculty interactions ($r = 0.78$), and intellectual and active learning ($r = 0.77$). In terms of facilitator prompts, social was most predictive of supportive campus engagements (0.79), organizational was most closely related to enriching academic experiences ($r = 0.72$), while intellectual was most closely related to both faculty interactions ($r = 0.78$) and active learning ($r = 0.77$) respectively.

Table 9

Pearson Correlations of Instructor Prompt and Category of Engagement

Instructor Prompt	**Academic Challenge**		**Active and Collaborative Learning**		**Faculty Interactions**		**Enriching Academic Experiences**		**Supportive Environments**	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Social	0.09	0.687	0.23	0.277	0.21	0.321	0.18	0.388	0.79	0.000***
Organizational	0.40	0.046*	0.63	0.001***	0.60	0.002**	0.72	0.000***	0.53	0.007**
Intellectual	0.54	0.006**	0.77	0.000***	0.78	0.000***	0.54	0.005**	0.19	0.371

Note. Engagements are compiled per class session and correlated with the number of instructor prompts in that same session. r denotes the correlation coefficient.
*Denotes significant relationship ($p < 0.05$). **Denotes significant relationship ($p < 0.01$). ***Denotes significant relationship ($p < 0.001$).

Academic Challenge. The results of the correlational analysis of instructor prompt and academic challenge (see Figure 4) revealed that significant relationships exist for both intellectual ($r = 0.54$) and organizational ($r = 0.40$) instructor prompts. The highest correlational coefficient for this category of engagement revealed that intellectual prompts explained up to 29% of the variance of this variable. However, no significance

was found between social prompts and the academic challenge category of engagement (r = 0.09).

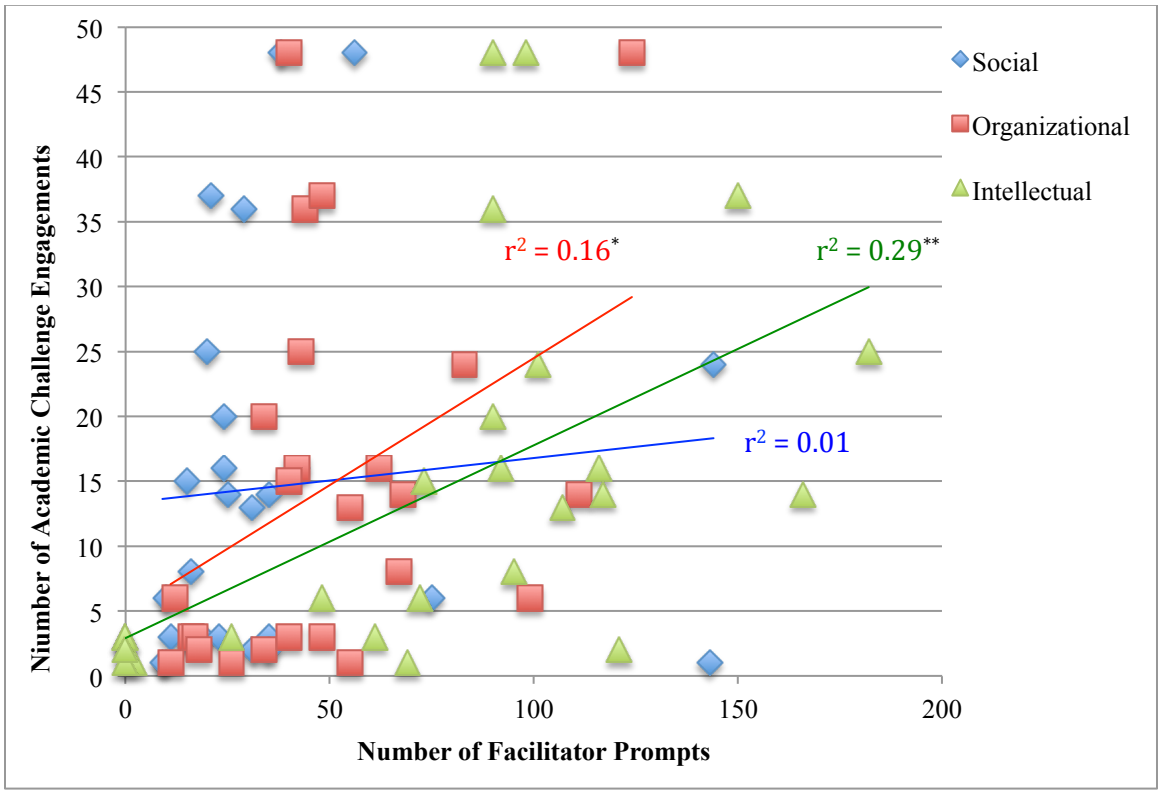

Figure 4. Correlational analysis between facilitator prompt and academic challenge. Intellectual prompts were most closely related to producing engagement classified as being academically challenging. Number of facilitator prompts and engagements both represent individual class totals.
*Denotes significant relationship ($p < 0.05$). **Denotes significant relationship ($p < 0.01$). ***Denotes significant relationship ($p < 0.001$).

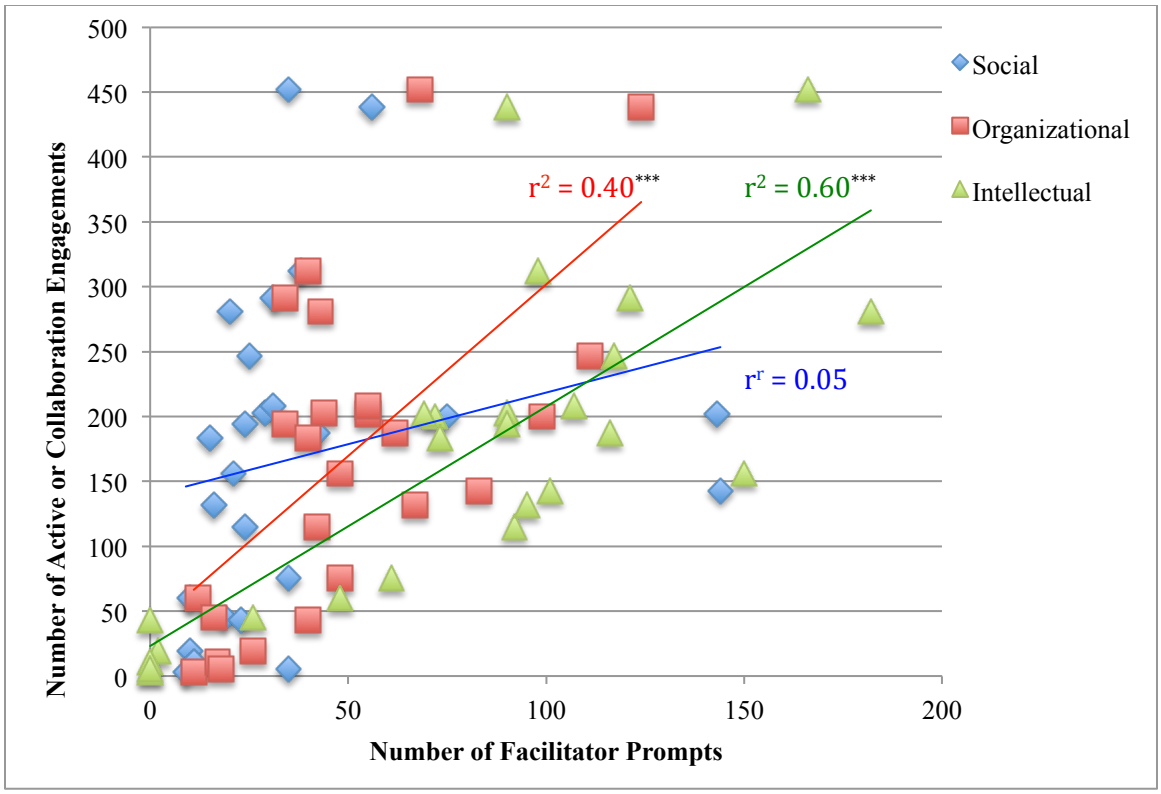

Figure 5. Correlational analysis between facilitator prompt and active or collaborative engagement. Intellectual prompts were most closely related to producing engagement classified as being active of collaborative. Number of facilitator prompts and engagements both represent individual class totals.
*Denotes significant relationship ($p < 0.05$). **Denotes significant relationship ($p < 0.01$). ***Denotes significant relationship ($p < 0.001$).

Active and Collaborative Learning. The results of correlational analyses between instructor prompt versus the active and collaborative learning category of engagement are shown in Figure 5. Intellectual prompts produced a significantly high correlational coefficient ($r = 0.75$) with a strength of relationship considered to be strong while explaining 60% of the variance in this variable. Organizational prompts also produced a statistically significant relationship that was of moderate strength ($r = 0.64$). The small relationship ($r = 0.23$) between social prompt and active engagement was not found to be significant.

Faculty Interaction. Organizational and intellectual prompts were found to be significantly related to faculty interaction. Intellectual prompts produced a high strength of relationship ($r = 0.78$) where 61% of the variance in the category of faculty interaction was explained through intellectual prompts. Organizational prompts also were found to be significantly correlated to faculty interaction ($r = 0.59$) while social was not significantly related. These data for the faculty interaction category of engagement are displayed in Figure 6.

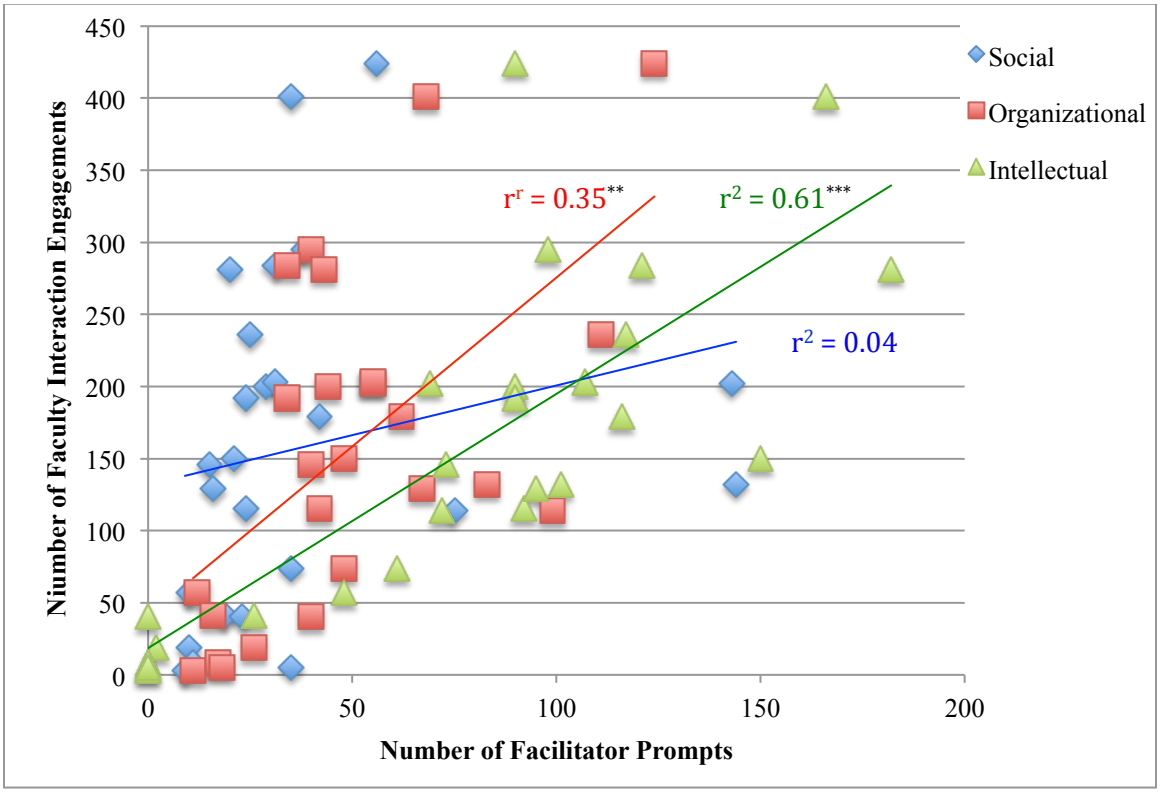

Figure 6. Correlational analysis between facilitator prompt and faculty interaction engagement. Intellectual prompts were most closely related to producing engagement classified as being between student and the faculty member. Number of facilitator prompts and engagements both represent individual class totals.
*Denotes significant relationship ($p < 0.05$). **Denotes significant relationship ($p < 0.01$). ***Denotes significant relationship ($p < 0.001$).

Enriching Academic Experiences. Both organizational and intellectual prompts were found to be significantly related to enriching academic experiences (see Figure 7). Organizational prompts were found to have the highest correlational coefficient (r = 0.72), which suggests a moderate to high strength of relationship where 51% of the variance in this category of engagement is explained by organizational instructor prompts. Intellectual prompts were related to enriching experiences but only moderately so (r = 0.60) because 29% of the variance was explained by these prompts. Social prompts produced a very low strength of relationship (r = 0.18) that was not found to be significant.

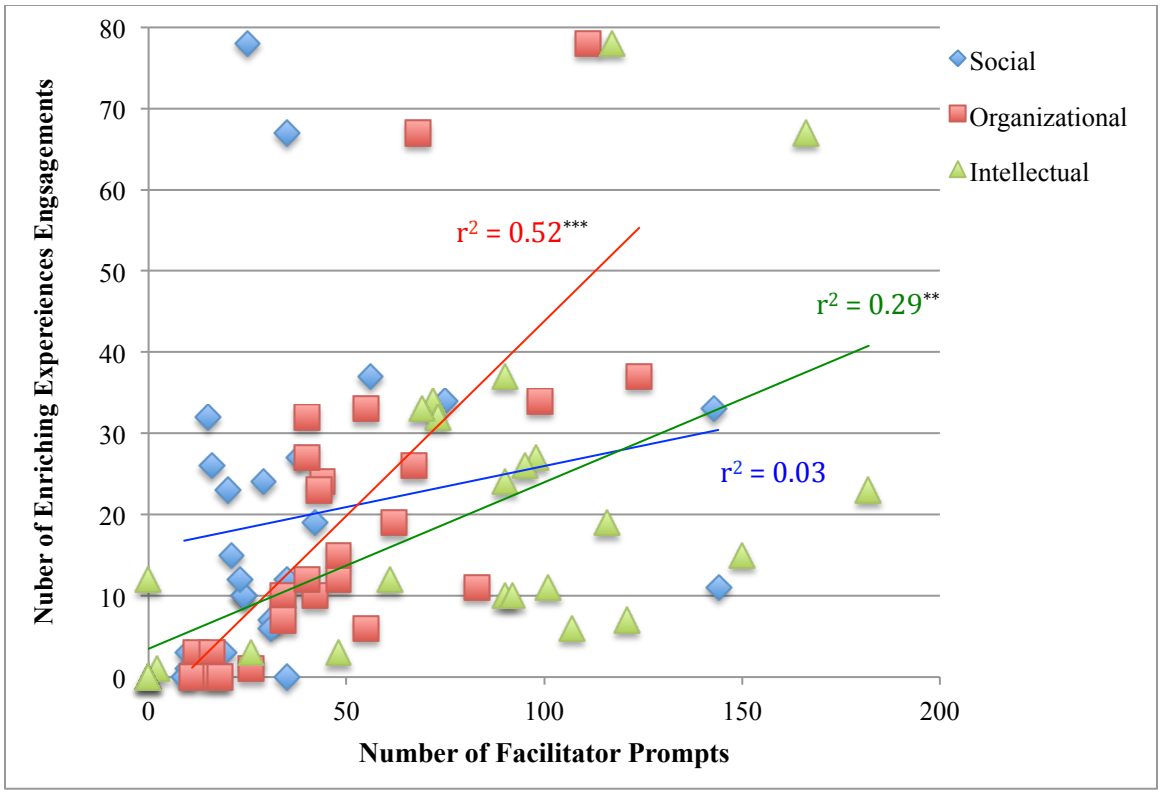

Figure 7. Correlational analysis between facilitator prompt and enriching experience engagement. Organizational prompts were most closely related to producing engagement classified as being an enriching academic experience. Number of facilitator prompts and engagements both represent individual class totals.
*Denotes significant relationship ($p < 0.05$). **Denotes significant relationship ($p < 0.01$). ***Denotes significant relationship ($p < 0.001$).

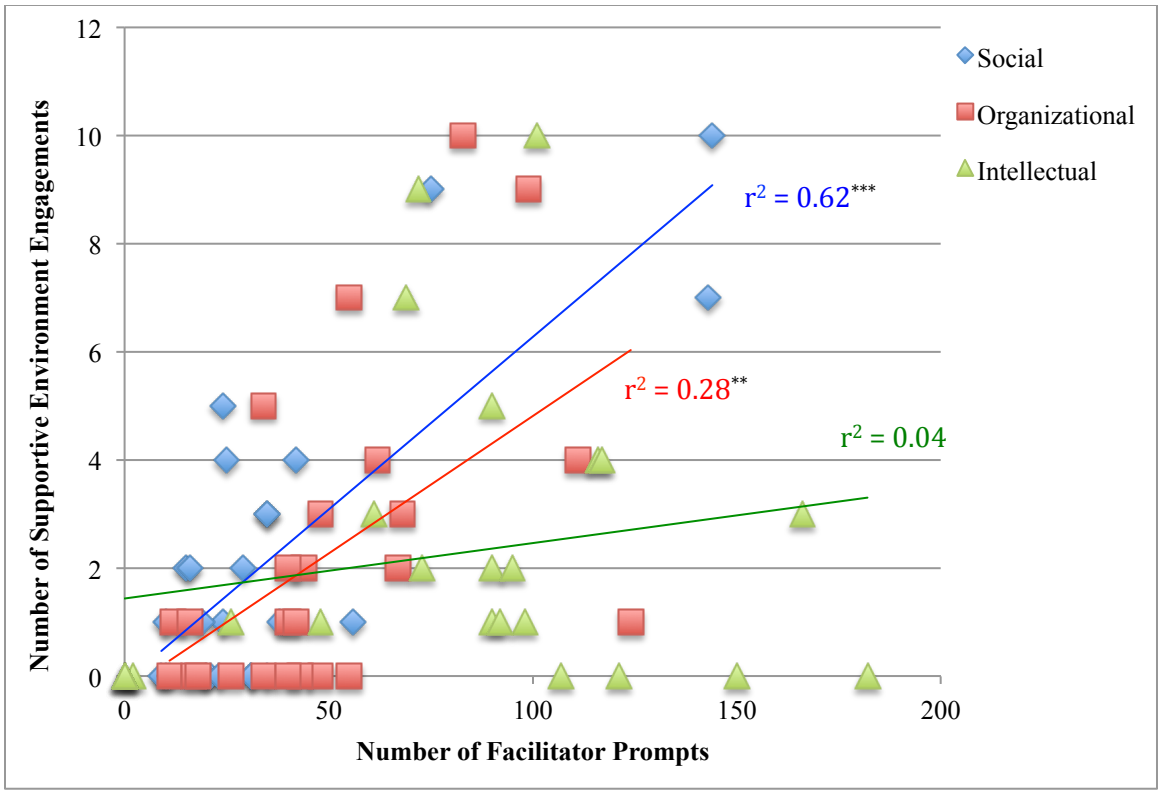

Figure 8. Correlational analysis between facilitator prompt and supportive environment engagement. Social prompts were most closely related to producing engagement classified as providing a supportive campus environment. Number of facilitator prompts and engagements both represent individual class totals.
*Denotes significant relationship ($p < 0.05$). **Denotes significant relationship ($p < 0.01$).
***Denotes significant relationship ($p < 0.001$).

Supportive Campus Environments. Social prompts were shown to have a statistically high strength of relationship with providing a supportive campus environment ($r = 0.79$). As shown in Figure 8, social prompts explain 62% of the variance between these variables. Organizational prompts from the instructor were significantly related to supportive campus engagements with a moderate strength of correlation ($r = 0.53$). Intellectual prompts, while showing a low strength of relationship ($r = 0.19$), were not statistically related to supportive campus environments. Correlations

between instructor prompt and supportive campus environments are illustrated in Figure 8.

Relationship Between Instructor Prompt and Student Engagement

Social. Correlational analysis revealed a number of strong relationships between prompts used by the instructor and the types of engagements seen during a normal synchronous class session. Speaking in a predictive nature, social prompts are only but very significantly related to supportive campus environments. One student said in the post-questionnaire "the class sessions allowed me to still feel that I was a part of a class." While another more extensively and profoundly added

> class time was the best part of class. I feel that we bonded really close as a class compared to other online classes. You [the instructor] were very energetic, helpful, and very relaxed. It helped take a lot of pressure off us and made it feel less of a class/lecture and more like a learning/critical thinking game (like playing volleyball to have fun, and not knowing or forgetting, that your burning calories). Very informative and very insightful! I find that you are very knowledgeable and are very easy to communicate with.

These synchronous sessions did promote not only social engagement, but facilitated what students suggested were meaningful and supportive relationships with peers and faculty. These quotes give us insight that in this digital world, learning communities can be created between the student cohort as well as the instructor in a manner that supports the academic objectives of the class. The lesson learned here is twofold. First, social does play a valuable role in education by at least in this data providing likelihood of supportive campus environments for students. This is most important because while organizational

prompts also provided a moderate strength of relationship, the variance was 62% vs. 28% in favor of social prompts in order to elicit supportive engagements. Second, social was not significantly related to any other category of engagement. Therefore, it is advised that if the intent is to provide supportive environments, especially as might happen at critical junctures in the semester such as the first day of class, following a poor exam, or before the final assignments are concluded, then perhaps the class sessions should be structured to include more social activities. Conversely, instructors should be made aware that should engagements other than supportive environments be targeted with a lesson, it is not recommended to include a high number of inherently social activities as a vehicle for these outcomes.

Organizational. Organizational prompts demonstrated the highest strength of relationship with enriching academic experiences, followed by active collaborations, and instructor interactions. There were however, additional significant relationships with academic challenge and supportive environments. Organizational was the prompt with the greatest predictive nature for enriching academic experience ($r^2 = 0.52$), surpassing intellectual ($r^2 = 0.29$) and social ($r^2 = 0.03$) by a large margin. The mechanisms and thus organizational uses of synchronous class sessions are numerous but evidence to effective delivery comes from this student quote that said "I liked the format of Adobe Connect™, with the chat window, web-cam, and the ability to share screens. I found it to be a very interesting and interactive way to teach an online class." This is powerful insight produced by the students who suggest that the numerous possible functionalities are well received and effective. Another interesting point is that chat interactions

dominated during the synchronous sessions where 90% of all interactions were offered via the chat window. Far from being a detractor, one student said that

> the class sessions relied heavily on the chat box and for me this was not a problem at all. In fact, I think it was the most effective way to communicate online in comparison to individual video chats or other means. The instructor was able to provide lots of information, charts, links, etc in a fast and efficient way and even a person lacking technical savvy could enjoy using Adobe Connect.

Here we see that chat only conversations are not to be avoided and perhaps greater benefit can be achieved through better understanding of the advantages of this medium. These would include such factors as parallel conversations, perceived anonymity, and equity of position between student and instructor (Burnett, 2003; Lage, et al., 2000; Lobel, et al., 2002). Other research supports our current finding that text is useful and enjoyed by students when supported by other learning activities (Baker, 2000; Shotsberger, 2000).

We recommend therefore that if the learning objectives include requirements for translational, transformational, or diversity exposure then proper organizational prompts are the most likely to produce these outcomes. Perhaps this relationship is explained by the notion that these forms of engagement rely heavily on social constructs of learning where the engagement requirement might somehow be mediated through conversations with other people who represent differences in background, ethnicity, experience, race, religion, etc. from the primary learner (Bruner, 1966; Vygotsky, 1978). Therefore, instructors who craft classroom activities with forethought where students would be encouraged to share personal experiences, data, or stories might promote greater

exposure of their peers. Insomuch as this is intuitive, care must be taken so the instructor provides a safe, non-inhibiting environment such that students are comfortable disclosing personal information while the peers are also allowed or encouraged to contribute to the conversations to satisfy their own inquiries and curiosities.

Intellectual. The strongest correlations for intellectual were seen in active, collaborative learning ($r^2 = 0.60$) and faculty interactions ($r^2 = 0.61$). Active and collaborative learning are therefore areas of engagement that can be achieved through content-based or promoted aspects of instruction. Through leading questions, making declarations or suppositions, and modeling thinking behaviors, student might be encouraged to be more active in the conversation. The intention of this class design included recommendations from prior research (Burnett, 2003; Lage, et al., 2000) where "mentors who acted as authority figures were found to be detrimental to interactive behaviors such as exchanging and debating ideas, or sharing interpersonal information" (Lage, et al., 2000, p. 6). This is rational in synchronous communication because the instructor, in leading a discussion through these forms of intellectual prompts is putting more of the onus on the student to participate actively in the class session. To this point, one student said "I also liked how we were free to take the class where we wanted." In effect, the instructor is moved to the center of the discussion but not in the front of it metaphorically speaking, as it would be in F2F instruction.

For our purposes, it is most likely that the large number of active and collaborative engagements that were coded were mostly categorized on the basis of being active learning in nature and not as much as a result of student-student collaborative interactions. This is because our data only indicates 13% of the student interaction as

being directed to another student. Proportionally, this is a small percentage, but our analysis identified a total of 1,230 student-student interactions in the two classes combined. This still represents a substantial value of 40 interactions between peers per student over the length of only five classes (8 interactions per class per student).

Intellectual prompts are seemingly the best way to elicit student-faculty engagements. The explanation for this might lie in the notion that intellectual prompts are those that are most likely to require students to rely on the instructor for guidance, scaffolding, and steering during these prompts. Additionally, one of the advantages of synchronous online sessions over F2F instruction is that when questions are provided to the class, an assumption is that every student need offer a response of some type prior to the class advancing. This is uniquely unlike F2F in that when questions are given to the class at-large, because of the serial nature of oral communication, only a small sample of students might offer their thoughts before the class moves on because of time delays in having to wait for each person to orally communicate their position. While online, each and every student can be constructing their own opinions concurrently (in parallel) in such a way as all student contributions can now be made in the same time that it used to take to hear one student's response (Johnson, 2006; Lobel, et al., 2002). If questions are sufficiently provided to elicit mandatory responses to all students then active participation and engagement appears to increase. This suggestion therefore includes the stipulation that closed-ended answers with a known response will not work as well at promoting active and full engagement of all students compared with opinion, personal experiences, or interpretive cues. An example of this is the attempt to make the prompts relatable to the student. We can compare one question from our transcripts where the

instructor asked via text “how do you feel when CHO are low?” This question is asking students to contribute their own personal symptomatic experience with low blood carbohydrate levels. In this form, every student has an answer to share. Most likely and hopefully in this case, their stories will have similar threads suggestive of fatigue, exhaustion, light-headedness, lethargy, and perhaps headaches caused by hypoglycemia. If the question had been phrased “what are the symptoms of hypoglycemia?” the prompt would have turned to an answer-seeking endeavor where when one student provides the correct answer and the remainder might not feel it appropriate to contribute further. This would decrease the total engagement rates class-wide by selectively stimulating only particular students who were either quicker to arrive at the answer, or faster keyboardists. Using this data in a prescriptive manner, instructors should use prompts that are more specific to the student and require all students to contribute. Instead of soliciting a known answer to a question, they should phrase the prompt in a way that that values the response of each student. The message here is also one that demonstrates the difference between anecdotal to one of a more scientific sampling example. By asking for the class to contribute, they are directly demonstrating a sample of data that can then be compared to the textbook answer to identify similarities and differences. Nonetheless, this data shows that with the instructor playing a role in prompting students through discussions, activities, or lessons, intellectual prompts seemingly succeed at predicting a high rate of student activity. This occurs likely through students directly responding to questions, suggestions, or tasks provided to them by the instructor.

Relationship of Student Behavior and Class Performance

Interaction Rate. The results of a correlational analysis between interaction behavior and class performance is show in Table 10. The number of classes attended showed the highest correlational coefficient and was statistically related to the overall class performance as determined as a percentage of overall grade ($r = 0.58$). However this did not translate to a notable relationship to final exam percentage. With this moderately strong direct relationship, as the number of classes increased, the overall class percentage increased as well. Also significant to final grade percentage was the ratio of words per interaction, which was found to have a low-to-moderately strong positive relationship ($r = 0.35$). Likewise as the ratio of words exchanged per interaction increased, the overall class performance increased as well. The number of total interactions showed trends towards significance ($p = 0.16$) with a low strength of direct relationship with overall class percentage, but was inversely related to exam performance although non-significantly as well.

Table 10

Pearson Correlations Between Interaction and Exchanged Words Variables Versus Final Exam and Overall Class Performance Displayed Per Student

		Final Exam		Final Grade	
	Mean ± SD	*r*	*p*	*r*	*p*
Classes attended	4.7 ± 0.5	0.13	0.48	0.58	0.00*
Words per interaction	8 ± 2	-0.15	0.41	0.35	0.05*
All session totals per student					
Interactions	283 ± 120	-0.21	0.26	0.26	0.16
Text interactions	254 ± 102	-0.25	0.17	0.24	0.20
Oral interactions	28 ± 28	0.00	0.97	0.23	0.21
Words exchanged	2,255 ± 1092	-0.25	0.18	0.08	0.68
Text words exchanged	1,538 ± 736	-0.30	0.10	-0.05	0.78
Oral words exchanged	716 ± 575	-0.09	0.63	0.22	0.24
Per class totals per student					
Interactions	60 ± 26	-0.20	0.29	0.13	0.47
Text interactions	54 ± 27	-0.24	0.19	0.10	0.60
Oral interactions	6 ± 6	0.04	0.85	0.22	0.24
Total words	482 ± 248	-0.25	0.17	-0.10	0.63
Text words	332 ± 177	-0.30	0.10	-0.23	0.22
Oral words	152 ± 118	-0.08	0.68	0.15	0.41

Note. All data with above are given per student. Correlations with final exam scores and overall class performance were based on a percentage. Only students completing the final exam are represented here. Only the normal non-exam sessions of a complete, non-partial nature were included in this table in order to best represent the normal classroom session. A normal class session was intended to run 90 minutes, but many went up to five minutes late. This data includes all additional communication via webconferencing tools that were captured in recordings and some resulting in interactions lasting up to 20 minutes after the conclusion of the class session.

*Denotes statistically significant correlation ($p < 0.05$).

The results of this study suggests that there is no relationship between the total numbers or type of interaction and their performance outcomes as assessed with either final exam score or overall class percentage. Supporting this finding is a descriptive rank-ordered histogram of mean per class student interaction rate is shown in Figure 9. Each student's rate of interaction per class is identified while each of their respective data bars is color coded to identify their final exam score. Students scoring above 90% on their final exams include mean interaction rates of 32, 43, 60, and 89 posts per class attended. Two of these values fall above the class median and two occur below. Similarly, students scoring less than 60% on the final exam had interactions rates of 18, 40, 61, 76, and 104 per class attended where two of these occur below the class median and three above. Additional support of this null finding comes from the correlational analysis shown in Table 10 where it was shown that no significant relationships were found between interactions, word counts, and class performance. This was somewhat a surprising finding in that we might assume that greater participation would be associated with greater performance outcomes. However, we did see that as the number of words exchanged per interaction was significantly ($p = 0.05$) and positively associated ($r = 0.35$) with overall class performance. This brings into question the notion that quality might be more indicative and predictive than quantity. By their very nature, text interactions are short and intended to be very concise. On the other hand, oral interactions produce far more words per unit than text (42 vs. 6 on average). During the instances when students were presenting information in class, higher-performing students were able to speak at length about article summaries or in answer to questions by the instructor that were entirely uninterrupted. On the other hand, the lower performing students needed

additional prompts, confirmations, and steering questions to continue their presentations. This seems to increase the number of words per interaction and is shown through a relationship with the overall grade.

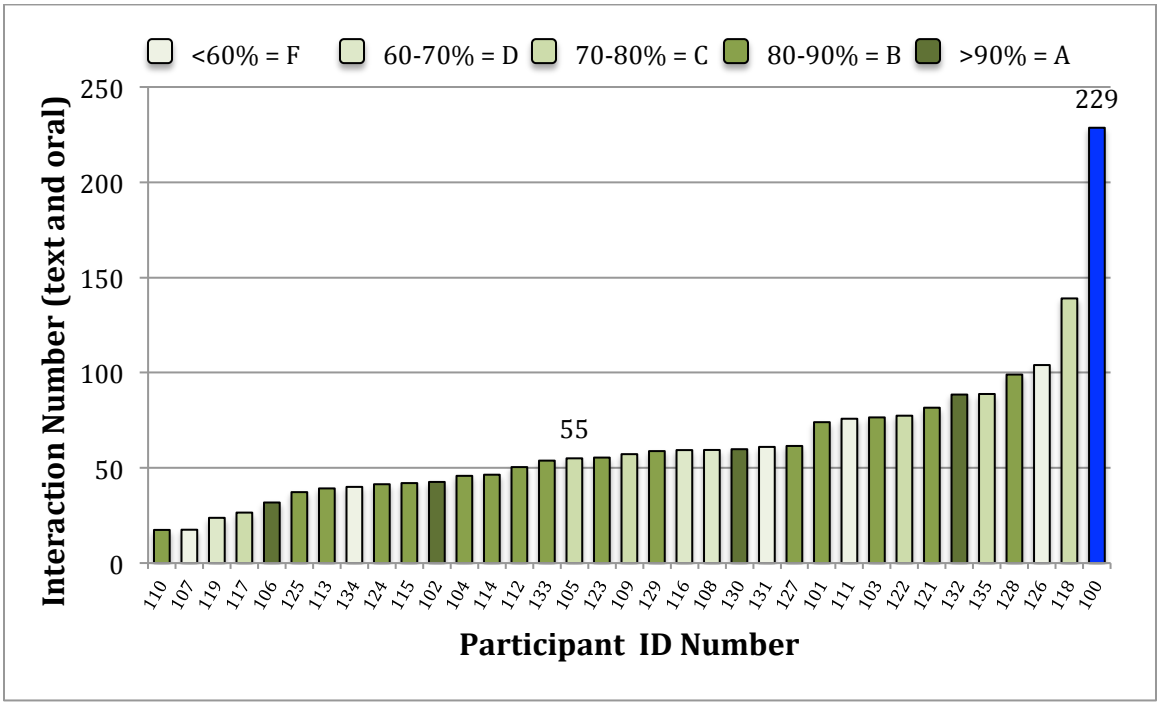

Figure 9. Mean interaction per participant and instructor for all complete, non-exam classes ranked according to final exam score. The distribution of interactions was not suggestive of class performance as seen by both higher and lower class grades appearing above and below the class mean respectively. The mean number of posts per participant is presented with the instructor (100) visible on the far right in blue. The students are ranked from left to right according to the mean number of total (oral + text) posts per class with the left being the least and the right being the highest number of posts. Means were calculated by the total number of chats per person divided by the number of class sessions attended. Participant number 105 represents the median mean of student interactions per class and is displayed above.

The mechanism behind a null finding for engagement versus performance is multifactorial and complex. Higher performing students might feel both more inclined to participate in the discussion as a means to learn through their experience, while at the same time, others might not feel compelled to interact as frequently in order to acquire

this information. Lower performing students might be intrinsically disengaged with the material resulting in a low participation rate while others of their cohort might be attempting to make up for a lack of aptitude on standardized tests by participating more frequently. Whatever the reason behind this, it is evident that few conclusions or recommendations as to interaction rate from this data can be made at this time.

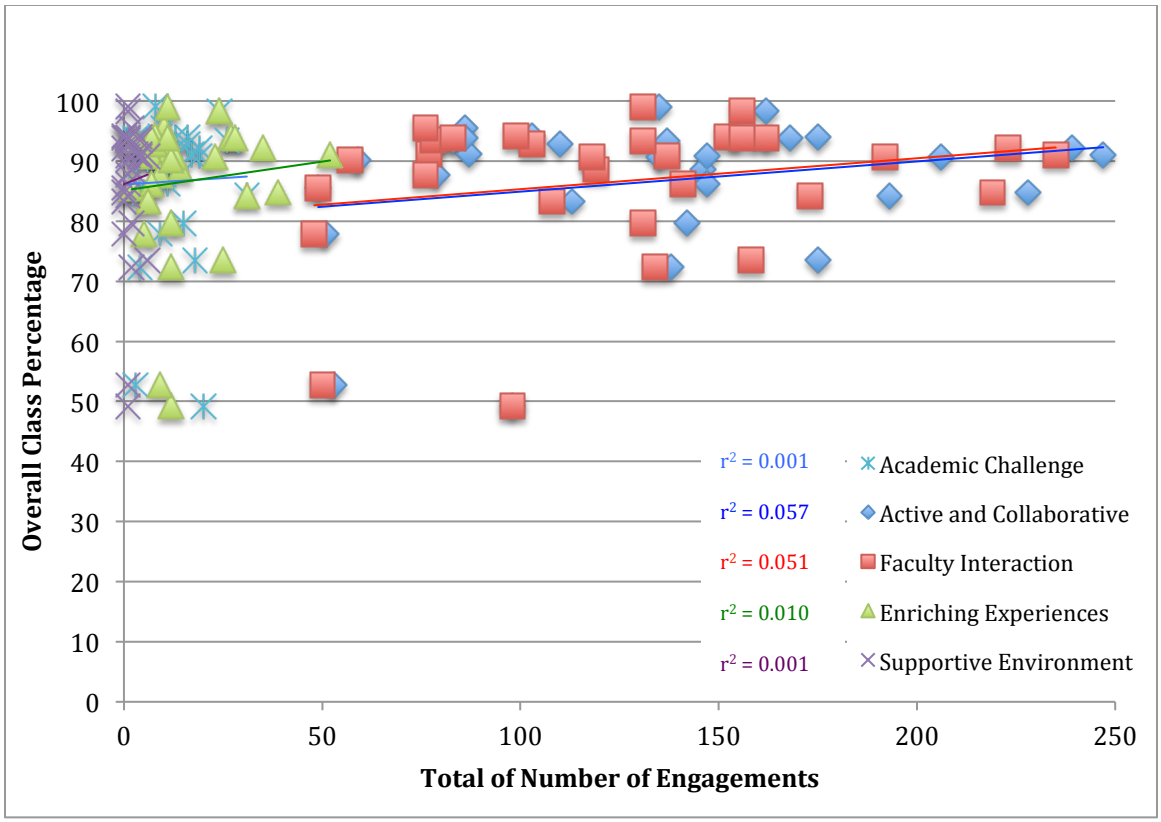

Figure 10. Pearson correlations of student engagement and overall class performance. No relationship was seen for any type of engagement and overall class performance. Each of the engagements are compiled as a comprehensive total per student and correlated with the overall class percentage. r^2 denotes the coefficient of determination.

No statistical differences were found for any correlations of any engagement category for final exam score or final overall class percentage. All correlations were shown to have very weak relationships ($r < 0.1$) that were not statistically significant. All of the correlations for engagement category versus overall class performance are

presented in Figure 10. An additional correlation analysis between the percent of interactions deemed superficial (inverse of percentage interactions that were coded as engagements) and both final exam score and overall percentage also were not found to be significant ($r < 0.1$). Figure 10 shows the results of the multiple regressions on engagement as a predictor of class performance, which were not significant ($r = 0.45$, $p = 0.44$). While no individual variable was a significant predictor of either exam or overall class percentage, active learning ($p = 0.16$) and faculty interaction ($p = 0.15$) demonstrated the greatest trends.

This study provides evidence that engagement as defined and coded in this investigation is not predictive to final exam or overall class performance. We were able to identify two variables significantly related to class performance: classes attended and the mean number of words per interaction. Increasing numbers of class attended increases the likelihood of overall class success. This by itself is perhaps not surprising, as one would assume and likely predict that by attending classes, one might be exposed to a greater number of learning opportunities which would result in elevated performance on classroom assessment metrics. From this data, we are unable to determine whether this was a causative nature or merely a correlational relationship. If it were causal, we would be able to confidently say that the act of attending class would increase class performance. A correlational relationship might suggest that the act of attending class is not the cause of the increased performance, but that the students attending more classes might be inherently higher performing students. We do know that participation as stated on the syllabus was 24% of the overall class grade so the variables of class performance and attendance as we have defined them are dependent to some degree on one another.

Participation in total, required students to not only attend and participate in synchronous class sessions but also to contribute to learning management system blog sites and discussion boards. Specifically, each of the five possible class sessions attended were valued at approximately 1% of the overall grade. Because engagement was related to class performance but did not show significance in exam performance further supports the dependence of these variables where to some extent, attending class increases the performance grade, which increases overall grade. The summary of these combined findings suggests that any insight as to engagement and performance as we have measured should be generalized with caution.

Despite the lack of predictive value of performance from engagement frequency, we can learn quite a bit from a practical pedagogical perspective. First, a discussion of research methodology is appropriate. We are limited in two ways on our ability to examine what relationships might exist. First, all evidence of engagement in this analysis had to be expressed overtly via one of the recorded synchronous sessions. While this is a powerful strength for reliability, we are clearly missing engagements that are unseen in text or unheard in oral communication. In short, our methodology has no way to determine the quantity or quality of student engagement occurring intrinsically to the student. If a student thought an answer but did not provide evidence to it in the form of a chat of oral interaction, it is lost in this research design. However, I am unaware of any other metric by which these currently missed engagements actually can be quantified which represents a methodological limitation of all engagement studies. Second, concern that the exam is not capturing potential learning paradigms provided from class is also possible. Again, this would be similar to other class and research settings where learning

objectives are legitimately difficult to assess via examinations. Student remarks from the questionnaire do provide additional support to this concern. The class sessions were stated to have been a

> good opportunity to talk about how nutrition relates to our everyday life. The class session I enjoyed the most was the final meeting we had. I liked that the upcoming chapters were introduced with video trailers and clips. It got me more excited and interested in the upcoming chapter's content.

In this quote we see evidence of benefit outside the traditional knowledge outcomes that education often prioritizes. By identifying application to life, the student is speaking to a translational engagement (enriching academic experiences) that would not be easy to determine in standard examination protocols as used in this and other science classes. Notwithstanding, the student also mentions the affective benefit of enthusiasm and perhaps inspiration to engage in this material independently as a result of these opportunities in class. The class might not be serving the purpose of content delivery, but at least for this student, a benefit is conveyed in that they are excited about what is to come. Third, the comprehensive performance data included in this analysis does not represent a normal distribution due to a bimodal tendency. This is shown where three students earned very low scores and eventual grade of *F* for the class. However, there were no grades of *D* given, which suggests a split between students that completed all tasks and assignments versus those that did not. It is possible that upon secondary future analysis, either through the elimination of these low-performing outliers or by controlling for them, this data might reveal a detectable relationship between performance and engagement.

In this study, there is unquestioned evidence of student engagement across a spectrum of categories. This would suggest that in the light of these engaging experiences, there should be some collateral progress made on the part of the student to learn more about nutrition. However, this engagement did not seem to translate to exam or overall class success. One suggestion that comes from this conclusion is that other forms of assessment need to be included that indeed would be better suited at capturing the broader realm of student learning outcomes where affective and translational domains might be at present missing from the assessment picture. This recommendation might also be viewed as supporting a revision of the current testing protocol or weight-adjustments in the evaluative process.

Student Perceptions of Engagement

The student perceptions of the synchronous class sessions that were provided through the questionnaires are shown in Table 11. In total, 28 students completed this required survey. This number represents a 90% respondent rate (28/31) with the survey data as three students failed to complete the course for a grade. In total, all but one student (3.5%) expressed some degree of disagreement compared to 96.5% who were therefore neutral or in agreement that the "online lectures were an effective use of class-time." All (100%) student respondents were neutral or in agreement that the synchronous sessions were enjoyable to some degree. The mean numeric value for each of these questions (i.e. 4.5 out of 5 on Likert Scale) suggests that the average student response was between agreement and strong agreement with each of these statements.

Table 11

Student Perceptions of Effectiveness and Enjoyment of Synchronous Class Sessions

	SD	D	N	A	SA	Mean
The online lectures through [Adobe Connect or Webex] were an effective use of "classtime."						
	0	1 (4%)	3 (11%)	5 (18%)	19 (68%)	4.5
Overall, I loved attending the online class sessions using [Adobe Connect or Webex].						
	0	0	4 (14%)	5 (18%)	19 (68%)	4.5

Note. During the first summer session class Adobe Connect™ and during the second summer session Webex was used the synchronous class tools respectively. The mean value represents an arithmetic mean of values calculated after assigning each category a Likert number where 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree. SD = strongly disagree, D = disagree, N = neither agree nor disagree, A = agree, SA = strongly agree.

In total, during the analysis of each question marking some category of student engagement, only 138/139 (99.03%) of respondents identified any level of disagreements. This indicates that students were unanimously free of disagreement in suggesting the (a) course activities contributed to their learning, (b) that they had adequate interaction with peers and the (c) instructor, (d) the university provided them with a quality learning experience, and (e) that they thought they belonged to a community or learners. The mean for each of these numeric totals (4.3-4.7) suggests that the average response was somewhere between agreement and strong agreement. The data for student perception responses from the questionnaire items assessing constructs of engagement are provided in Table 12.

Table 12

Student Perceptions of Effectiveness and Enjoyment of Synchronous Class Sessions

	SD	D	N	A	SA	Mean
The course activities and assignments contributed to my learning.						
	0 (0%)	0 (0%)	0 (0%)	9 (32%)	19 (68%)	4.7
I had adequate interaction with other students.						
	0 (0%)	0 (0%)	2 (7%)	17 (61%)	9 (32%)	4.3
I had adequate interaction with the instructor.						
	0 (0%)	0 (0%)	0 (0%)	10 (36%)	18 (64%)	4.6
LMU met my expectations by providing a quality learning experience.						
	1 (4%)	0 (0%)	1 (4%)	11 (39%)	15 (54%)	4.4
^I felt like part of a learning community.						
	0 (0%)	0 (0%)	1 (4%)	11 (41%)	15 (56%)	4.5

Note. During the first summer session class Adobe Connect™ and during the second summer session Webex was used the synchronous class tools respectively. The mean value represents an arithmetic mean of values calculated after assigning each category a Likert number where 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree. SD = strongly disagree, D = disagree, N = neither agree nor disagree, A = agree, SA = strongly agree. ^ Denotes that the last sample was based on 27 respondents instead of 28 with the other questions in this table.

Students resoundingly enjoyed the synchronous sessions. Most of the comments provided by students stated appreciation for quick communication, diverse delivery, community building, interaction, and support for personal application of material. Specific student perceptions in favor of the synchronous session included statements such as they liked getting "to know the other students in the class and hear what they have to say about the different topics," one student who said "I did enjoy the class discussions and I participated to my fullest ability," and finally another student who offered that "I enjoyed contributing and also enjoyed hearing what my classmates had to say." These

selected quotes reflect the general tenor of the student questionnaire feedback where positives were numerous. Perhaps the most comprehensive student response stated that the interactions were

> very realistic, and I felt that I was actively participating. The topics generated in the chat box made us think and discuss topics which improved our learning a lot. I also loved the interaction with the Professor since I could ask questions and have an immediate answer. Other questions that rose from my classmates also helped me achieve a lot of knowledge in this course. I love how the interaction is set up, its very interactive and well fit for this course. I would love to have suggestions on how to improve this, but its what I would enjoy doing if I had another online course.

Multiple themes across all of the engagement categories studied in this investigation are present in the previous excerpt. Suggesting a high volume of learning speaks to academic rigor. Fortunately in this case, this is not represented in a derogatory manner. Here the student is acknowledging that being made to think among other factors promoted a high learning effect. Active and collaborative learning is present in the student's own use of the term interactive. While hesitancy was provided in whether they were indeed "actively participating" we cannot empirically confirm this either due to the anonymous nature of our questionnaire because it is not possible these two sources of data together. However, the student belief that they participated is likely a positive outcome by itself. Collaboration is stated in the manner of appreciation for being exposed to classmates' thoughts. Faculty interactions are seen in presenting student inquiry and immediate feedback mechanisms. Enriching academic experiences are seen

through “realistic” experiences, student “generated” topics, and diversity exposure from their classmates. Finally to a lesser degree, there are implications for support in the last sentence where the instructor has solicited suggestions but none are being provided by the student, which reflects satisfaction and suggests a continuation of existing protocols.

In addressing the few detractors of the synchronous sessions, one comment giving evidence to the dissenting voice suggested that

> there were some aspects that were very informative and we were able to take parts of the week’s topic and expand on them. There were others parts that we simply seemed to get off topic, so it just got boring and felt like a waste of time.

Another student offered that

> what I wanted more from the class, and the reason that I said (slightly) disagree as far as effective use of classroom time is I felt that there was a disconnect between what was discussed in the class sessions and the content from the text.

These two statements suggest perhaps a lack of clarity provided by the instructor as to what might have been the intention of these sessions. Disclosure that the students were expected and encouraged to have tangential conversations would have informed the minority opinion so that expectations and perceptive reality could have been more in agreement. Further, encouraging students to see beyond the goal of textbook mastery towards other factors of enriching academic experiences could have benefitted this understanding. However, this would then need to be supported by a more robust and varied form of student evaluation as discussed previously in order to reward these outcomes.

Summary

This dissertation, using a mixed-method investigation was undertaken to investigate the relationships between instructor prompt and student engagement in five areas based on the Seven Principles of Good Practices in Undergraduate Education (Chickering, et al., 1987) using recorded chat, video, and audio transcripts of two recent fully online nutrition courses. A student questionnaire collected at the conclusion of the course provided additional qualitative evidence in corroboration of the data from the transcripts. With each student providing an average of 297 interactions throughout the semester with more than 46% of these demonstrating some deeper level of engagement, the results of this analysis confirmed that a high rate of interaction and student engagement was possible in synchronous class sessions. Moreover, despite a high rate of instructor interaction, students dominated the class discussions where the rate of interaction varied between two and three student interactions for every instructor interaction across all class sessions. Not all categories of engagement were equally evidenced in this analysis. This finding suggests that online synchronous class sessions can be very successful at facilitating active and collaborative learning and student-faculty interactions. Academic rigor and enriching educational experiences can also be strongly facilitated through synchronous online class sessions. It was hypothesized that the differential role of the instructor could promote varying engagement experiences for students. Here, the data showed that in fact, the instructor's behavior does provide insight of a predictive nature as to the type of engagement that would likely be seen. No statistical link was found between the quantified student engagement and their performance in the class suggesting a mismatch between class evaluation and

synchronous class participation. The students reported overwhelming rates of both perceived effectiveness and enjoyment from the synchronous class sessions. Their responses suggest that they favored the dynamic, student-driven discussion style of these sessions. While we did not directly assess translational or transformational behaviors in a prospective, longitudinal manner, a second recurrent theme was student reporting of translational and transformational life application of the synchronous discussions. In summary, instructors can use a variety of prompts to engage students across a spectrum of engagement categories in synchronous online class sessions while promoting student perception of benefit and enjoyment at the same time.

Chapter 5 – Conclusions and Recommendations

The expanding scope of online education demands that further work be done to help shape the practices of this newer form of educational delivery. There are now more than 19 million students enrolled in institutions of higher learning in the United States (Allen & Seaman, 2010) and annual enrollments continue to see increases varying between 1-3% in the past ten years. The dynamic nature of an ever more globalizing and technological world demands the pursuit of the most effective and efficient manner of educating the students of tomorrow (Bowen, 2012; Clothey, 2010; Dutschke, 2009; Green, Luu, & Burris, 2008).

This dissertation used a mixed-method investigation into the relationships between instructor prompt and five areas of student engagement based on the seven Principles of Good Practices in Undergraduate Education (Chickering, et al., 1987) using recorded chat, video, and audio transcripts of two recent fully online nutrition courses. This is the first study to directly examine recorded synchronous online class transcript for student engagement according to NSSE (National Survey for Student Engagement, 2011) and this investigation therefore gives a firsthand account of realtime student engagement during synchronous online class sessions. Here, the data showed that the instructor's behavior does provide insight of a predictive nature as to the type of engagement that would likely be seen in online synchronous sessions. Because no statistical link was found between the quantified student engagement and their performance in the class, this suggests a mismatch between class evaluation and synchronous class engagement. The students reported overwhelming rates of both perceived effectiveness and enjoyment from the synchronous class sessions. Their responses suggest that they favored the

dynamic, applied, student-driven discussion style of these sessions. More specifically, this study has produced the following conclusions:

1. Online synchronous class sessions can be used to promote student engagement.

Student engagement is the key to success in educational settings (Chickering, et al., 1987; National Survey for Student Engagement, 2000). Inline with the definitions of the NSSE (National Survey for Student Engagement, 2011), online synchronous class sessions can promote high incidence rates of active and collaborative learning, student-faculty interaction, enriching educational experiences, and academic challenge. To a lesser extent, engagement in a supportive campus environment can also be achieved with synchronous online class sessions. During an entire condensed summer course of online nutrition, synchronous tools alone can produce an average of at least 134 instances of active or collaborative learning, 125 instances of faculty interactions, 16 instances of enriching academic experiences, 12 instances of academic challenge, and 2 instances of supportive campus environments per student.

2. Online synchronous class sessions can be moderated via differing instructor actions to promote student interactions.

There are three categories of prompts that online instructors can use to promote interactions in synchronous online classes: social, organizational, and intellectual (Burnett, 2003). Our data suggests that per class, the number of prompts can be expected to average 165 of which there will be 79 intellectual, 50, organizational, and 36 social

prompts per class. Over the course of a semester, this can accumulate over 2000 prompts per course with a range of 150-600 prompts per class session.

3. The actions of the instructor are related to the type of student engagement.

The role of the instructor is vital to facilitate the establishment and maintenance of learning environments of any structured educational kind. Our data gives support to the notion that differing instructor actions are capable of producing differing student behaviors. In particular: (a) *intellectual prompts* are highly correlated to active, collaborative learning and faculty interactions which suggests that should learning objectives include these forms of engagement, intellectual prompts would be the dominant recommended form of instructor prompt. (b) *Organizational prompts* are highly correlated to enriching academic experiences suggesting that instructors consider these prompts when targeting this engagement category in synchronous learning activities. (c) *Social prompts* demonstrate the highest strength of relationship to engaging students in supportive campus environments. This suggests that success in engaging students in this category might best be achieved through intentional social interactions perhaps more commonly used at the beginnings and endings of class sessions and courses in general.

4. We were unable to demonstrate a link between student engagement and performance outcomes.

Our data was unable to show a relationship between student engagement and class performance variables. A multiple regression analysis with all five categories of

engagement showed only low strength of relationship ($r = 0.44$) that was not statistically significant. Individually, each category of engagement was also unable to demonstrate significance with correlation coefficients ranging from 0.03-0.22. The summary of this data suggests that the current class performance metrics are not valid for detecting the engagement that is occurring in these online synchronous courses. An additional further analysis where attention is paid to statistical outliers in performance might demonstrate a true relationship between engagement and performance. Lastly, engagement frequency and type are not useful in predicting class performance according to the current evaluative process of these students.

5. Students report that the actions of the instructor can promote student engagement in online synchronous classes. They further report an appreciation of the educational effectiveness of this form of course delivery.

Online synchronous class sessions are both effective and enjoyable to students. The online synchronous class sessions were considered to be an effective use of class time for 85% of students in the class with another 11% remaining neutral with this statement. Not a single student displayed disagreement with a question related to enjoyment such that 100% of students marked neutral or some agreement with the statement that said, "I loved attending the online class sessions." Further, by wide margins, students reported that they were engaged in class in multiple ways.

Contributions to the Literature

Overall student engagement is the most important factor in successful learning in higher education. As such, it is one of the most discussed topics in research literature.

As of this paper, there were over 3,000 citing articles of the original work on the Seven Principles for the Best Practices in Higher Education originally published 25 years ago (Chickering, et al., 1987). Later examination of the Seven Principles resulted in the creation of the National Survey for Student Engagement that has existed since its launch in 2000. Over the 12 years of its existence, the NSSE has been completed by 1,500, 4-year institutions in North America. In the past year alone, more than 416,000 students complete the NSSE representing data from over 670 institutions of higher learning (National Survey for Student Engagement, 2011). This institutional assessment is provided in the framework of retrospective, perceptive student feedback each year throughout institutions of higher education. This study examined recorded synchronous online class transcripts of evidence of student engagement according to the standards advocated by the NSSE (National Survey for Student Engagement, 2011).

This study supports previous work (Batts, et al., 2006) demonstrating student and faculty perception that high levels of engagement occur during synchronous class activities and that students can in fact be engaged with these techniques. For example, during the course of a single five-week summer undergraduate course taught entirely online, we found students to average 289 instances of direct-evidenced engagement through synchronous actions alone. Furthermore, these engagements occurred in a variety of different categories including academic challenge, active and collaborative learning, faculty interactions, and enriching educational experiences. This number represents a large volume of learning opportunities that otherwise might never have been provided to students should the course have been run exclusively with asynchronous tools. While this study did not include an examination of the asynchronous aspects of

these online courses, others have provided ample evidence that asynchronous activities provide value such as scheduling flexibility and greater reflective opportunity that are likely to be provided during synchronous events (Branon & Essex, 2001; Mayadas, et al., 2009). Therefore, the proper blending of these two forms of online activities is advised in meeting the particular learning objectives of every online course (Johnson, 2006).

In promoting the engagement of students, instructors play a powerful role and from the results of this study, we have been able to provide a suggestive link between the type of actions that instructors use and what result they might be able to achieve in terms of student engagement. Following the work of Burnett (2003) who originally grouped the behavioral prompts for instructors in synchronous events into social, organizational, and intellectual activities, we can now suggest a greater pairing of intent with potential outcomes. As an example, if a major learning objective of the course is to promote assimilation to campus environments, college work expectations, or community building, then a high use of social prompts are likely to achieve these desired goals. Learning activities would then need to be implanted and time set aside to directly address through interactive exchanges the development of supportive campus environments. However, in contrast to this, it is very unlikely that a high volume of success might be had in cognitive learning domains specific to any discipline with a high reliance on social prompts. To achieve this, it would be recommended to design learning opportunities that would be more intellectual in nature. Additionally, the instructor, unlike many traditional lecture formats in F2F education does not have to be the dominant figure in online synchronous class sessions. Similar to Kear et al. (2011) and Duemer (2000), our findings support the notion that one of the most important aspects of online synchronous classes is that

instructors begin to view computer-mediated communication as distinctly different that traditional F2F forms of interaction. This paper provides evidence that throughout entire classes, the number of instructor posts can be outnumbered by a factor of 3:1. In this form, the students as a collective whole have now become another significant source of classroom content, flow, and direction. The transition to student-centric is suggested by Kear et al. (2011) to be a desired learning relationship but one that can be impeded by novice instructors attempting to translate F2F instructional techniques to synchronous class sessions.

Lastly, students demonstrated a high level of enjoyment which is coupled with their perception that synchronous class events are engaging, interactive, and communal in the approach to learning supporting previous studies (Dickey, 2003; Lage, et al., 2000; Lobel, et al., 2002; Locatis, Fontelo, Sneiderman, Ackerman, Uijtdehaage, Candler, Stensaas, & Dennis, 2003; Shotsberger, 2000). By an overwhelming margin (85%), students reported that synchronous class sessions were a valuable use of class time and they also stated that they loved the online class sessions (85%). This data adds to the affective domain of education and likely serves as a powerful internal motivation to students in their other learning activities. Students also reported that the course activities and assignments contributed to their learning (100%), that they had adequate interaction with other students (92%), that they had adequate interaction with their instructor (100%), and that they felt like they were part of a learning community (100%). Most importantly, the students agreed that the course provided them with a quality learning experience by a 92% margin. Because these summative questions were not specific to

the synchronous sessions per se, it is not possible in this analysis to differentiate these from the other course experiences.

Recommendations for Future Research

This is the first study to directly examine recorded synchronous online class transcripts for evidence of student engagement according to the standards advocated by the NSSE (National Survey for Student Engagement, 2011). This investigation therefore gives a firsthand account of realtime student engagement in coursework and shows that high rates of student engagement can occur during synchronous online class sessions. Notwithstanding, type and frequency of engagement appears to be related and most likely mediated directly by the actions of the instructor. Student engagements as measured here are not indicative of class performance as currently evaluated. We feel that care should be taken when interpreting these results. As engagement across a spectrum of categories has been accepted as a worthwhile goal of higher education, perhaps student evaluation might be reconsidered in order to capture underlying learning resulting from engagement that is not currently part of the assessment process in undergraduate science courses. Nonetheless, this research has been unable to elucidate the likely link between engagement and class performance possibly as a result of low face validity of student evaluation at least in the courses examined here. Regardless, as interpreted, this data shows that a variety of instructor prompts must be used in order to promote student engagement across a number of different categories. Finally, care should be taken in order to craft and facilitate learning activities in synchronous online class sessions in order to achieve desired learning outcomes.

Following any investigation, the analysis and resulting findings should serve to germinate additional research lines of inquiry. First, the inability to find a relationship between our quantified engagement and student learning outcomes is somewhat puzzling. Time spent with material should equate to learning more about said material (Kuh, 2003) and in this case we are not suggesting that learning did not take place as a result of this quantified engagement, but rather our performance metrics were unable to capture it and therefore describe it. A second analysis would be recommended in order to better clarify the spectrum of learning categories and identify mechanisms for assessing these in otherwise traditional science content classes.

The second area of future investigation would be to unpack the contributions of asynchronous versus synchronous activities in class engagement and student performance. This investigation specifically identified explicit evidence of student engagement through transcripts of recorded live class sessions. An additional advantage of online courses is that a digital log or archive potential exists for every single class activity and evaluation. This differs from many traditional F2F deliveries where assignments have to be given back to students and conversations are mostly passing with no recordings produced at any time. This unique aspect of online instruction would allow for additional direct examination of student engagement using methodologies as in the present study to retrospectively look at email correspondence, discussion board posts, turned in assignments, and other LMS supported course activities to better categorize the potential for engagement across all aspects of an online course. This comparison would potentially give great insight as to whether synchronous forms of instruction were uniquely able to provide for certain types of engagement. Of course, the goal of further

teasing out the specific engagement eliciting potential of known advantages to synchronous and asynchronous tools (Johnson, 2006; Mayadas, et al., 2009) would be in order to best blend these two different tools in best achieving the learning outcomes of every course.

Thirdly, a comparison of online to traditional F2F classes would help to delineate the differences between these two types of course delivery. A study intended to further describe differences between online and F2F could include an analysis of objective student engagement as described in this dissertation during F2F classes that are more lecture style as well as those that are more discussion-based or that rely more on active learning. By establishing a sort of baseline expectation of student engagement in these other forms of course delivery, the combined findings of this comparison would clarify the practical significance of the large volume of engagement herein described.

Lastly, this small-sample, specific investigation produces exciting findings as to the efficacy of synchronous instruction in prompting student engagement. However, a broader recommendation of these findings could be achieved through additional future longitudinal investigations with tighter research controls and additional courses. Repeats of this investigation could easily be achieved with different instructors across future classes in order to corroborate or refute these findings as it pertains to the techniques, tools, the student cohort, or the instructor per se. It is also only speculative whether the findings are specific to the content of the course, which does suggest that investigations like this one need to be repeated across additional disciplines.

Summary

The future of higher education is now in a state of transition where online supported instruction is certain to play a larger role. The evaluation of the tools used to mediate developing online course deliveries is essential to ensure that they are used effectively and efficiently in the promotion of learning. For over a quarter century now, educators have relied on promoting student engagement as the fundamental goal of higher education. While others had previously shown that instructors and students alike perceived high rates of engagement in synchronous class sessions a study directly assessing student engagement according to well-established criteria such as the National Survey for Student Engagement was lacking. Furthermore, while some work had been done to describe the possible moderating roles of the instructor in synchronous class sessions, the specific relationship between instructor actions in promoting these experiences had also not been previously examined. Therefore, the purpose of this dissertation was to perform a mixed-method investigation into the relationships between instructor prompt and student engagement. A second purpose was to determine whether engagement was related to student performance. The results of the data analysis produced the following five major conclusions:

1. Online synchronous class sessions can be used to promote student engagement.
2. Online synchronous class sessions can be moderated via differing instructor actions to promote student interactions.
3. The actions of the instructor are related to the type of student engagement.

4. We were unable to demonstrate a link between student engagement and performance outcomes.
5. Students report that the actions of the instructor can promote student engagement in online synchronous classes. Students further report an appreciation of the educational effectiveness of this form of course delivery.

This analysis found that online synchronous class sessions are capable of promoting high frequency rates of student engagement with each student averaging 289 total engagements during their respective class sessions. Because the data showed differing strength of correlation between prompt and engagement, it is evident that in order to promote all engagement categories a variety of instructor prompts must be used. Finally, care should be taken in order to craft and facilitate learning activities in synchronous online class sessions in order to achieve desired learning outcomes. Specifically, (a) social prompts are most useful in promoting a supportive environment for students (b) intellectual prompts are most effective at promoting interactions with faculty as well as active, collaborative learning (c) organizational prompts are most predictive of engaging students in enriching academic experiences. As always, this study does not conclude the work in describing the best practices in synchronous class session instruction. Future work is needed to continue to uncover the complementarity benefits of asynchronous and synchronous tools of online delivery alike in order to lessen the inhibitive boundaries of novice instructors to this course delivery while at the same time increasing the effectiveness of veteran online instructors.

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PEPPERDINE UNIVERSITY

Graduate & Professional Schools Institutional Review Board

August 8, 2012

Todd C. Shoepe
Loyola Marymount University
1 LMU Drive, MS 8160
North Hall 201
Los Angeles, CA 90045

Protocol #: E0712D05
Project Title: ***Engaging Undergraduate Students in an Online Science Course: The Relationship Between Instructor Prompt and Student Engagement in Synchronous Class Sessions***

Dear Mr. Shoepe:

Thank you for submitting your application, *Engaging Undergraduate Students in an Online Science Course: The Relationship Between Instructor Prompt and Student Engagement in Synchronous Class Sessions,* for exempt review to Pepperdine University's Graduate and Professional Schools Institutional Review Board (GPS IRB). The IRB appreciates the work you and your faculty advisor, Dr. Paul Sparks, have done on the proposal. The IRB has reviewed your submitted IRB application and all ancillary materials. Upon review, the IRB has determined that the above entitled project meets the requirements for exemption under the federal regulations (45 CFR 46 - http://www.nihtraining.com/ohsrsite/guidelines/45cfr46.html) that govern the protections of human subjects. Specifically, section 45 CFR 46.101(b)(4) states:

> (b) Unless otherwise required by Department or Agency heads, research activities in which the only involvement of human subjects will be in one or more of the following categories are exempt from this policy:
>
> **Category (4) of 45 CFR 46.101**, 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 subjects cannot be identified, directly or through identifiers linked to the subjects.

Your research must be conducted according to the proposal that was submitted to the IRB. If changes to the approved protocol occur, a revised protocol must be reviewed and approved by the IRB before implementation. For any proposed changes in your research protocol, please submit a **Request for Modification Form** to the GPS IRB. Because your study falls under exemption, there is no requirement for continuing IRB review of your project. Please be aware that changes to your protocol may prevent the research from qualifying for exemption from 45 CFR 46.101 and require submission of a new IRB application or other materials to the GPS IRB.

A goal of the IRB is to prevent negative occurrences during any research study. However, despite our best intent, unforeseen circumstances or events may arise during the research. If an unexpected situation or adverse event happens during your investigation, please notify the GPS IRB as soon as possible. We will ask for a complete explanation of the event and your response. Other actions also may be required depending on the nature of the event. Details regarding the timeframe in which adverse events must be reported to the GPS IRB and the appropriate form to be used to report this information can be found in the *Pepperdine University Protection of Human Participants in Research: Policies and Procedures Manual* (see link to "policy material" at http://www.pepperdine.edu/irb/graduate/).

Please refer to the protocol number denoted above in all further communication or correspondence related to this approval. Should you have additional questions, please contact me. On behalf of the GPS IRB, I wish you success in this scholarly pursuit.

Sincerely,

Jean Kang, CIP
Manager, GPS IRB & Dissertation Support
Pepperdine University
Graduate School of Education & Psychology
6100 Center Dr. 5th Floor
Los Angeles, CA 90045
[redacted]

cc: Dr. Lee Kats, Associate Provost for Research & Assistant Dean of Research, Seaver College
Ms. Alexandra Roosa, Director Research and Sponsored Programs
Dr. Yuying Tsong, Interim Chair, Graduate and Professional Schools IRB
Ms. Jean Kang, Manager, Graduate and Professional Schools IRB
Dr. Paul Sparks
Ms. Christie Dailo

APPENDIX B

Wednesday, July 25, 2012 10:14:43 AM PT

Subject: IRB Approval/Shoepe LMU IRB 2012 S 84
Date: Wednesday, July 25, 2012 8:44:17 AM PT
From: Paterson, Julie
To: Shoepe, Todd C.
CC: Hardy, David J., Carfora, John, Paterson, Julie

Dear Dr. Shoepe,

Thank you for submitting your IRB application titled *Engaging Undergraduate Students in an Online Science Course: The Relationship Between Instructor Prompt and Student Engagement in Synchronous Class Sessions*. All documents have been received and reviewed, and I am pleased to inform you that your project has been approved.

The effective date of your approval is **July 25, 2012 – July 24, 2013**. If you wish to continue your project beyond the effective period, you must submit a renewal application to the IRB prior to **June 1, 2013**. In addition, if there are any changes to your protocol, you are required to submit an addendum application.

For any further communication regarding your approved study, please reference your new protocol number: **LMU IRB 2012 S 84**.

Best wishes for a successful research project.

Sincerely,

Julie Paterson

[redacted]

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APPENDIX C

Student Questionnaire

Online Student NTLS 255 Evaluation Summary

1. The McGraw-Hill Connect homework assignments were useful in facilitating and encouraging my learning of the nutritional content of this course.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

2. Overall, I loved doing the McGraw-Hill Connect homework assignments.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

2. Please comment on the positives/negatives of the McGraw-Hill Connect homework assignments and provide suggestions on how to improve this aspect of the course.

4. The online lectures through Adobe Connect were an effective use of "classtime."

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

5. Overall, I loved attending the online class sessions using Adobe Connect.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

6. Please comment on the positives/negatives of the class sessions provide with Adobe Connect and then provide suggestions on how to improve this course requirement.

7. The feedback on assignments, discussion boards, journals, I received from my professor and TA was useful in my learning.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

8. Overall, I loved receiving feedback on assignments, discussion boards, and journals.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

9. Please comment on the positives/negatives of the feedback you received from your professor/TA regarding your assignments, journals, discussion boards, etc.

10. I thought the Skype conversation was a valuable way to interact with the professor, ask questions, and promote my learning in this class.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

11. Overall, I loved the Skype conversation.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

12. Please comment on the positives/negatives of the Skype conversation in promoting interaction, discussion, and learning in this class and then comment on how this course requirement can be improved.

13. I thought the photos blog (breakfast, lunch, dinner) was a valuable way to promote learning in the class.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

14. Overall, I loved the photos blog (breakfast, lunch, dinner).

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

15. Please comment on the positives/negatives of the photos blog (breakfast, lunch, dinner) and then provide suggestions on how to improve this course requirement.

16. I thought the dietary analysis assignment (Part I, Behavior Change, Part II) was a valuable way to promote learning in this class.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

17. I thought the Chapter Video Lectures of the professor delivering content (through iTunes U) was a valuable way to promote learning in this class.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

18. I loved the Chapter Video Lectures where the instructor provided content (iTunes) in this class.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

19. Please comment on the positives/negatives of the Chapter Lecture Videos (iTunes) and then provide suggestions on how to improve this course requirement.

20. I thought the Portion Size Activities (Pre-Test, Learning Activity) were a valuable way to promote learning in this class.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

21. I loved the Portion Size Activities (Pre-Test, Learning Activity) in this class.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

22. Please comment on the positives/negatives of the Portion Size Activities (Pre-Test, Learning Activity) and then provide suggestions on how to improve this course requirement.

23. Based on your experience, how do you rate the quality of online instruction compared with traditional classroom courses?

Traditional Better	About the same	Online Better
1	2	3

24. Based on your experience, how do you feel the integrity of online instruction compares with traditional classroom courses?

Traditional Better	About the same	Online Better
1	2	3

25. LMU met my expectations of providing a quality learning experience.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

26. How many previous online courses have you completed?

No Previous Course	One Previous Course	Two Previous Courses
1	2	3

27. Which of the following are factors for your choice in enrolling in an online course? Please select all that are true.

_____Classes fit work hours

_____Family

_____Friends recommended

_____Alternative to regular classes

_____Traditional class unavailable

_____Transportation issues

_____Advisor recommended

_____Previous positive experience

_____Other

28. If a traditional class had been offered, would you have taken it?

Definitely not	Probably not	Probably	Probably not	Definitely
1	2	3	4	5

29. This course is what you expected.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

30. The course activities and assignments contributed to my learning.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

31. The supplemental materials (Ebook, Powerpoints, Video lectures, activities, discussion boards, food journals, dietary records) contributed to the learning experience.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

32. I had adequate interaction with the instructor.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	2	3	4	5

33. I had adequate interaction with other students.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

34. I felt like a part of learning community.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

35. I understood that this was a distance learning technology-based course when I registered.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

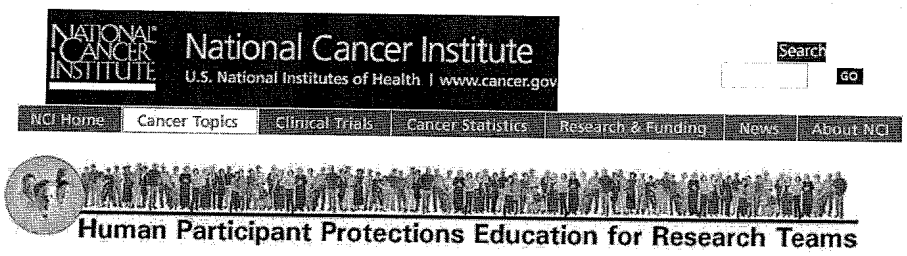
36. My knowledge/experience with technology was adequate for performance in a distance learning technology based course.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

37. Please comment on anything you would like to contribute that has not been addressed so far.

APPENDIX D

National Cancer Institute Human Subjects Training Certificate for the Principal Investigator



Completion Certificate

This is to certify that

Todd Shoepe

has completed the **Human Participants Protection Education for Research Teams** online course, sponsored by the National Institutes of Health (NIH), on 02/02/2007

This course included the following:

- key historical events and current issues that impact guidelines and legislation on human participant protection in research.
- ethical principles and guidelines that should assist in resolving the ethical issues inherent in the conduct of research with human participants.
- the use of key ethical principles and federal regulations to protect human participants at various stages in the research process.
- a description of guidelines for the protection of special populations in research.
- a definition of informed consent and components necessary for a valid consent.
- a description of the role of the IRB in the research process.
- the roles, responsibilities, and interactions of federal agencies, institutions, and researchers in conducting research with human participants.

National Institutes of Health
http://www.nih.gov

APPENDIX E

National Institutes of Health Human Subjects Training Certificate for the Research Assistant

Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Nicholas Mattos** successfully completed the NIH Web-based training course "Protecting Human Research Participants".

Date of completion: 08/18/2009

Certification Number: 267607