Perceived distance and instructional design in online agriculture and life science courses

Yahya S. Alotibi

Iowa State University

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Perceived distance and instructional design in online agriculture and life science courses

by

Yahya S. Alotibi

A dissertation submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of
DOCTOR OF PHILOSOPHY

Major: Agricultural Education

Program of Study Committee
Gregory S. Miller, Major Professor
Robert Martin
Michael Retallick
Denise Crawford
Scott Smalley

The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this dissertation. The Graduate College will ensure this dissertation is globally accessible and will not permit alterations after a degree is conferred.

Iowa State University
Ames, Iowa
2018
DEDICATION

This dissertation is dedicated to my parents, the first teachers in my life, who taught me the importance of being committed and responsible.

I also dedicate this research to my colleagues in the Department of Agricultural Extension and Rural Development at King Saud University, who supported and encouraged me to complete my education, those who saw the potentials that I possessed in an early stage of my professional life.
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ACKNOWLEDGEMENTS

Acquiring a doctoral degree has been a major goal of mine since I was completing my bachelor’s degree. My goal became a dream shared by many people around me. They supported me and pushed me hard to achieve this dream. I am thankful and grateful to my family and friends who stood by me during this strenuous and long journey. Big thanks to my mother, who inspires me to grow up and improve as a lifelong learner.

Special thanks to Dr. Greg Miller who has served as my advisor during my graduate program, providing guidance throughout my doctoral program of study and research. Thank you not only for supporting me and keeping me focused but also for teaching me how to enjoy doing research and to think out of the box. I would like to thank every member of my advisory committee: Drs. Robert Martin, Denise Crawford, Michael Retallick, and Scott Smalley who made my time at Iowa State University valuable and productive. I also would like to thank Drs. Wade Miller and Gaylan Scofield for serving in the panel of experts during the instrumentation stage.

I am forever grateful to the government of Saudi Arabia represented by King Saud University for providing the scholarship, which I consider as a turning point of my life. Thanks to faculty members and staff in the Department of Agricultural Extension and Rural Development for their encouragement and for supporting my continued professional development.
Last, but certainly not least, thank you to my dear wife who has been the best aspect of my life, who has been the closest person not only in my happiness and strength but also in my sadness and moments of weakness. Thank you for being such a patient, loving, and understanding spouse since day one of marriage. Thank you and congratulations, we have accomplished one of our dreams and we will pursue to accomplish the rest.
ABSTRACT

The purpose of this study was to describe relationships between factors that influence perceived transactional distance (course structure, course interaction, and learner autonomy) and instructional design aspects that help to reduce transactional distance from the learner's perspective. Using Transactional Distance Theory. Specifically, the study sought to identify the extent to which learners felt they were distant from their online course and describe relationships between online students’ perceived distance and factors of transactional distance (course structure, interactions, and learner autonomy).

An online survey was disseminated to 271 students who enrolled in online courses in the College of Agriculture and Life Sciences at Iowa State University during the fall of 2017. A final response rate of 26% (n=70) was obtained.

The perceived distance to the other online learners was the highest comparing to the perceived distance from instructor, course content, course website, and course overall. The perceived distance from the online instructor was higher than the perceived distance from the course website and course content.

The students’ perceptions regarding the course structure items were positive. Participants considered their online courses as highly structured courses. In general, the students’ perceived distance to the course overall was significantly and negatively correlated with all course structure components.

In terms of course interaction, participants considered the student-website and the student-content interactions in their online courses very high compared to student-instructor and student-student interactions. In general, the results showed that the
perceived distance from the course website, course content, instructor, and other online students negatively correlated with the frequency of interaction with the course website, course content, instructor, and other online students.

These results showed that online students in this study possessed a high level of autonomy. Also, the findings revealed the independent and self-directed learners who can learn without much guidance and can develop a personal learning plan perceived distance to the course content and the course website less than other students.

The squared multiple correlation coefficient ($R^2$) revealed that 38% of the variance in the overall transactional distance can be predicted from the combination of course structure, course dialogue, and learner autonomy.

Regarding the instructional design practices that help to reduce transactional distance, the online students indicated a well-organized syllabus, clear learning objectives, the instructor contact information, and printable materials are very important items in their online course. Also, the online students in this study indicated instructional design items which were of little importance included: online chat or videoconferences, group assignments, and group projects. These instructional design items are related to interaction.
CHAPTER 1: INTRODUCTION

Distance education has improved by taking advantage of the rapid development of technology. During the 1990’s, web-based education or online learning became the new face of distance education. The development of information and instructional technology during that period of the time has had an impact on the transformation towards web-based distance education (Saba, 2011). Different companies, innovators, and developers are working on creating new technologies and/or improving the existing ones. The educational sector is not isolated from this technological movement. Topics related to educational technologies such as smart devices, educational software, learning management systems (LMS), online learning platforms, and massive online open courses (MOOC) have become fundamental in educational conferences or educational journal articles.

The development of online learning provides open educational resources that include necessary knowledge and skills, not only for higher education but also, for lifelong learning and professional development. Moreover, online education reshapes learners and educators thinking regarding the educational process (García-Barriocanal, Sicilia, & Alonso, 2013). For example, online learning technologies provide opportunities for programs to offer learner-centered online courses that are developed to meet learner needs and interests. In this regard, Saba (1999) and Burgess (2006) indicated that the success of distance education depends on the ability of educational programs to integrate technology to personalize the educational processes, which increases the effectiveness and the efficiency of the online learning.
Online learning solutions not only provide options for on-campus students to take courses, but also provides learning opportunities for those who cannot participate in traditional education settings. In fact, there are educational institutions that continue to add distance education programs and grow existing ones. There has been steady growth in the number of students who enroll in web-based distance education. The enrollment grew to 5.8 million nationally since 2005, which is 29.7% of all higher education enrollments. The percentage of the distance students in higher education has increased each of the following years from 25.9% in 2012, to 27.1% in 2013, to 28.3% in 2014, and to 29.7% in 2015 (Allen & Seaman, 2017). In terms of the level of distance education, 29% who enroll in undergraduate programs have taken at least one course at distance, and 12.3% of the total undergraduate enrollment are exclusively taking distance courses. In addition, more than one third (34%) of the total students who enroll in graduate programs have taken at least one course at distance, and 26% of the total graduate enrollment is exclusively taking distance courses (The National Center for Education Statistics, 2017). Regarding the distance student’s location, 53% of students who are taking exclusively distance courses live in the same state as the institution that they are attending and 41% of distance students live in a different state than the institution they are attending. In addition, 2% of international students who are attending colleges and universities in the United States are doing so from outside of the United States (Allen & Seaman, 2017).

In Iowa, there are more than 50 institutions offering online courses. Of students enrolled in Iowa’s institutions, 39.7% are in fully distance programs and 83.1% of them are undergraduates. Unlike the national statistics that show 53% of exclusively distance
students live in the same state as the institution that they are attending, only 13.1% of distance students in Iowa’s institutions are living in Iowa. Iowa does an outstanding job attracting out-of-state distance students (U.S. Department of Education, 2014).

According to the previous statistics, educational institutions must pay careful attention to the distance programs. Focusing on the technologies used to deliver these programs is important, but focusing on the quality of the instructional design is important as well. That includes learning objectives, content, assignments, exams, and grading systems. Further, the focus on online instructional design includes establishing a communication plan between online instructors and their students and among online students. In 1995, the College of Agriculture and Life Sciences (CALS) at Iowa State University established the Brenton Center for Agricultural Instruction and Technology Transfer to facilitate teleconferencing and teaching at a distance. This center provides a variety of services including coordinating with departments in CALS in the process of developing, marketing, and maintaining online courses. Also, the center provides individual services using the related technologies, such as video recording and graphic design. In addition to individual online courses, CALS offers an online undergraduate program (Agriculture Studies Hybrid Online/Campus B.S.), two online certificates (Occupational Safety Undergraduate Certificate and Swine Science Online Certificate), five online graduate programs (Agricultural Education, M.S.; Agronomy, M.S.; Community Development, M.S.; Plant Breeding, M.S.; and Seed Technology and Business, M.S.), and four online graduate certificates (Agronomy Graduate Certificate, Food Safety and Defense Graduate Certificate, Seed Science and Technology Graduate Certificate, and...
Certificate, Seed Business Management Graduate Certificate) (Brenton Center for Agricultural Instruction and Technology, 2017).

The Significance of the Study

This study contributes to the literature of distance education by examining an important theory of distance education within the context of online learning. The Transactional Distance Theory is one of the most cited theories in the distance education literature. Since its publication in 1974, a variety of distance education have emerged and educational technologies have been released. According to Riggins (2014), in order to support the growth of online learning environments, courses need to be designed with an appropriate balance between the amount of student interaction and course structure. In this regard, Transactional Distance Theory can be considered as an instructional design theory that provides the necessary improvement for online learning environments not only in agricultural education, but also for online courses in other disciplines.

Twigg (2001) established a vision regarding how to move online learning beyond being "as good as" traditional education. He identified five challenges which face distance education within higher education institutions: (1) individualization of distance education; (2) improving quality; (3) increasing access; (4) reducing the costs of teaching and learning; and (5) sustaining technology integration. The findings of this study address the first three challenges. This study helps to individualize the distance education by providing some suggestions regarding developing student-centered programs and improving student-instructor interaction. Also, the findings include knowledge regarding online learning structure components that help to develop quality online courses.
The findings of this study emphasize the educational and social aspects of online learning environments. Knowledge generated by this study can be integrated with findings from instructional technology research to build a comprehensive vision for online learning environments. This can help to establish principles and practices for online learning enables online instructors and instructional designers to develop effective online programs using models and guidelines that are developed especially for online learning. Therefore, the findings of this study are important in practical and theoretical ways. The study serves the fourth priority on the National Research Agenda of the American Association for Agricultural Education 2016-2020 (Meaningful, Engaged Learning in All Environments) (American Association for Agricultural Education, 2016).

**Statement of Problem**

The rapid evolution of educational technologies does not give much time for educators and instructional designers to reflect on and evaluate their practices to make sure that they are following the right practices in terms of online learning. Sometimes, practitioners who are involved in online learning, ask themselves what are the right practices for these kinds of courses. Designing online courses is overlooked as an educational technology issue rather than an instructional design issue. This makes educators think about using technologies regardless the usefulness or appropriateness of technologies in the education process. Indeed, this could be a problem if we only think about the technology itself (Saba, 2011). Unfortunately, the technological aspect is not the only problem within the design process for online courses because there are educational and social aspects as well. Since instructors and learners are separated in online courses, more attention should be paid to creating distance education opportunities
using web features to reduce the potential gap between instructors and learners within the online environment.

Taking educational and social aspects into consideration while designing online courses leads to a comprehensive learning experience. However, the educational aspect includes the difference between traditional education and distance education practices. Courtney and Mathews (2015) stated that the online learning environments lack educational practices that are developed especially for online learning. At that time there were no inclusive models that were established only for distance education. Thus, most educators utilize practices of traditional education in designing online courses. Web-based programs should be designed according to their context. Moore and Wilson (2005) indicated distance education practices should be different from traditional education practices. Students in traditional courses had more interactions with their instructors and other students. Also, according to them students in face-to-face course perceived less distance comparing to online student. Therefore, Moore and Wilson (2005) concluded that distance education practices should be different from traditional education practices in terms of exams, assignments descriptions, and course interactions. In order to develop effective online courses, further research should be done to identify and understand distance education practices within the information technology field.

Developing online learning includes determining an approach for the learning process in terms of teacher-centered or learner-centered approaches. Before the Internet age, distance courses were structured to meet institutional objectives regardless of the special educational needs of each individual learner. This type of instruction was pushed to learners with a very low degree of interaction between learners and instructors.
Therefore, in order to build effective distance online courses, Saba (2011) emphasized the importance of investigating teacher-learner and learner-learner interactions. Stein, Calvin, and Wanstreet (2009) stated such investigation can help instructional designers to understand the learner’s point of view regarding the educational process at a distance.

There is still a great deal to learn about distance learning such as; the factors that influence learners to feel more connected to online courses; how these factors interact with each other and with perceived distance; instructional design practices that reduce gaps between online learners and components of the online learning environments. Therefore, these are some of the topics addressed in this study.

**Research Objectives**

The purpose of this study was to describe relationships between factors that influence perceived transactional distance (course structure, course interaction, and learner autonomy) and instructional design aspects that help to reduce transactional distance from the learner's perspective. This study addressed the following research objectives:

1. Describe the demographic characteristics of students in online graduate programs in the College of Agriculture and Life Sciences at Iowa State University.

2. Identify the extent to which learners feel they are distant from their online course (i.e. instructor, other learners, course content, and course interface).

3. Describe the relationship between learners’ perceived distance and their demographic characteristics.
4. Explore the online learners’ perceptions regarding the factors of transactional distance (i.e. course structure, course interactions, and learner’s autonomy).

5. Describe relationships between online students’ perceived distance and factors of transactional distance (course structure, interactions, and learner autonomy).

6. Predict perceived distance using course structure, dialogue, and learner autonomy.

7. Identify instructional design aspects that help to reduce the transactional distance in online learning environments.

**Limitations**

The limitations of this study are as follows:

- The low response rate in this study (26%) may impact how well the data reflect the population. However, the researcher conducted a mean comparison between early and late responses. There were no significant differences between the two groups.

- The courses were taught online and developed independently by their instructors, there were differences in the structure, interaction amount, and allowed learner autonomy of each online course. These specifications are likely to vary among online courses. The variations could not be controlled for this study. Thus, the results of this study should not be immediately generalized to all colleges that offer online courses.

**Delimitations**

This study is limited in its scope. It was restricted to 271 students who enrolled in online courses in the College of Agriculture and Life Sciences at Iowa State University.
during the fall semester of 2017. These students come from various locations, professions, and academic backgrounds but they all were taking online courses related to agriculture sciences.

This study is also limited to the investigation of transactional distance, the factors that influence perceived transactional distance (structure, interaction, and learner autonomy) within online courses in the College of Agriculture and Life Sciences at Iowa State University and the instructional design elements that help to reduce perceived transactional distance.

**Definition of Terms**

**Course interaction** is the degree or number of interactions between different entities within an online course (instructors, students, content, and online interface). These interactions may be spontaneous or designed with the goal of communicating ideas, thoughts, and persuasion (Blue, 2015; Fullwood, 2015).

**Course Structure** refers to the elements of course design that include educational objectives, teaching strategies, delivery system, and evaluation methods involved in an educational experience and their flexibility or rigidity (Moore, 1993; Lowell, 2004; Nwankwo, 2013).

**Instructional Design Aspects** are strategies and items that course developers used to build an online course that increases learner proficiency and decreases learner obstacles during the process of learning (Congress, 2015).

**Learner Autonomy** refers to the varying capacity of the student’s ability to make decisions about his or her learning and the extent to which students, rather than the
instructor, establish the characteristics of a learning program (Burgess, 2006; Moore, 1993).

**Learner-Content Interaction** is the process of intellectually interacting with content that results in changes in the learner’s understanding, the learner’s perspective, or the cognitive structures of the learner’s mind in order to accomplish the goals and the objectives of the online course (Pettazzoni, 2008; Zhang, 2003).

**Learner-Instructor Interaction** is the interaction between the learner and the expert who prepared the subject material or some other expert acting as an instructor (Zhang, 2003).

**Learner-Learner Interaction** is inter-learner interaction, between one learner and other learners, alone or in group settings, with or without the real-time presence of an instructor (Zhang, 2003).

**Learner-Website Interaction** is the interacting between the learner and the educational web interface that used to deliver instruction to accomplish a task (Zhang, 2003).

**Online Course** is a course delivered through the internet with no classroom or face-to-face component (Veale, 2009). This includes courses offered by higher education institutions to be available anytime and anywhere to students capable of connecting through a computer network (Burgess, 2006).

**Online Course Quality** is the level of excellence (Adams, 2017), from the user’s perspective (Miller and Pilcher, 2000). Course quality includes distinctive attributes in course interaction and structure that facilitate learning processes and helps to improve learners’ achievements and outcomes (Hathaway, 2003).
**Online Learning Environments** is the collection of procedures and devices necessary for a learner to participate in learning environments characterized by a separation in space and/or time between teacher and learner through the internet (Lowell, 2004).

**Perceived Distance** is the apparent separation that one participant in a learning environment feels toward other entities within an online course (instructors, students, content, and online interface) (Lowell, 2004).

**Transactional Distance** (TD) is the psychological distance or chasm caused by misunderstanding and/or miscommunication that may exist between learners and other entities within online learning environments (instructors, students, content, and online interface) (Blue, 2015; Moore, 1997).

**Organization of the Study**

This study contains five chapters. Chapter one includes background information about online learning, significance of this study, statement of the problem, research objectives, limitations, delimitations and definition of terms. The literature for this study is reviewed in Chapter 2. The literature review includes the theoretical framework (Transactional Distance Theory), factors that impact the transactional distance (interaction, course structure, learner autonomy), the relationships between these factors, Transactional Distance Theory in distance education, instructional design aspects that help to reduce transactional distance in online learning environments, and web-based education in agriculture education. The research methodology and procedures used for this study are explained in Chapter 3. Chapter 3 includes research design, data source, instrumentation, data collection, and data analysis. Chapter 4 reports the research findings...
according to the research objectives and questions. Finally, Chapter 5 includes a summary of the study, discussion of the research findings, conclusions, recommendations, implications, limitations, and suggestions for further research regarding future studies in online learning within agricultural education.
CHAPTER 2: LITERATURE REVIEW

Transactional Distance Theory

Usually, the distance education literature refers to Transactionalistance Theory when it intends to focus on the social aspect of the distance education. Moore, (1991) defines transactional distance as “a psychological space of potential misunderstandings, between behaviors of instructors and those of the learners” (p. 3). In another way, Moore and Kearsley (2005) define transactional distance as “the gap in understanding and communication between the teachers and learners caused by a geographic distance that must be bridged through distinctive procedures in instructional design and facilitation of interaction.” (p. 209). Moore (1993) stated that even traditional face-to-face education has a degree of transactional distance between the teachers and the learners. Therefore, Moore (1993) considered transactional distance as a relative rather than an absolute term. That means transactional distance may vary from one course to another. Also, the perceived transactional distance may vary from one learner to another in the same course.

The Relationship Between Factors Related to Transactional Distance

The transactional distance is not measured by the physical distance between the learners and their instructors, transactional distance is determined by the amount of structure that exists in the design of the course, the amount of dialogue that occurs between the learner and the instructor, and the degree of autonomy that an individual learner possesses (Moore, 1991, 1993; Saba, 2002). While course structure refers to the flexibility and the rigidity of the course design elements, dialogue refers to the amount of two-way interaction between the learners and the instructors in the online learning
environments (Burgess, 2006). Also, learner autonomy affects perceived distance and connectedness among learners. Peters (2007) states that there are three components that influence transactional distance (course structure, dialogue, and learner autonomy).

Moore (1993) stated that there is an inverse relationship between dialogue and transactional distance. Also, The Transactional Distance Theory indicated a positive relationship between course structure and transactional distance and between course structure and learner autonomy. That means, high structured courses have high transactional distance and less dialogue, thus, learners have to exercise more autonomy to be successful in distance education programs. Saba & Shearer (1994) and Moore & Kearsley (2005) confirmed the relationships between course structure, dialogue, and transactional distance. Thus, this theory claims that to overcome the gap of transactional distance, there must be a great amount of dialogue (Saba, 2011).

Moore’s Transactional Distance Theory is a pivotal theory in distance education research. Many scholars have conducted studies to measure, examine, and/or revise the Transactional Distance Theory within contemporary changes in distance education. Researchers in distance education used this theory in two ways; they used it as a theoretical framework for their research or with a set of theories to build conceptual frameworks for their studies. Research that used Moore’s theory, can be divided into two categories. The first category includes studies focused on the factors that relate to the transactional distance within online learning environments. The second category consists of studies focused on the transactional distance itself and other variables such as students’ satisfaction and/or academic achievements.
This literature review discusses the purposes and findings of some of the important studies conducted in both categories and how these studies shape the literature on distance education. Moreover, it highlights some studies related to instructional design aspects and practice that help to reduce transactional distance in online learning environments. This review concludes with an overview of studies regarding distance education within agricultural education at different levels.

**Dialogue and Interaction**

The first factor that influences transactional distance in distance education is dialogue. According to Moore (1993), dialogue has an inverse relationship with transactional distance. In order to provide a empirical support for the Transactional Distance Theory, Goel, Zhang, & Templeton (2012) examined the fundamental principles of the theory and tested them in a manner that is ontologically consistent with learners’ perceptions. This study supported the validity of the Transactional Distance Theory and the relationships between its three factors (structure, dialogue, and autonomy). Furthermore, it emphasized that dialogue, from learners’ perspective, is the dominant factor for perceived transactional distance. In addition, Farquhar (2013) highlighted dialogue as the factor that got the most attention in the Transactional Distance Theory. They indicated the constructivist pedagogy provides a fitting avenue for online instructors and instructional designers regarding how to develop interactive dialogue in order to acquire low transactional distance within distance education courses.

Researchers used different approaches to study transactional distance and related factors.
Kassandrinou, Angelaki, & Mavroidis (2014) qualitatively examined the presence of transactional distance among students, the factors affecting it, and the way it influences the learning process. Participants in this study indicated that they perceived a lower level of connectedness (high transactional distance) with their peers’ due to the lack of interaction among learners. Also, the participants mentioned the important role of the instructors to establish communication opportunities and encourage learners to interact with each other.

In the Internet age, many studies have been done to investigate emerging interaction types in online distance education. In this regard, Jung (2001) specified three types of dialogue that enhanced web-based courses; (1) academic interaction between learners and instructors and/or subject matter experts, (2) collaborative interaction between distance learners and (3) interpersonal interaction which considers learners’ engagement with course content and interface elements. Later, Zhang (2003) categorized interactions within web-based courses into four primary types of interaction; learner-instructor interaction is the most popular interaction in the educational process that provides motivation, feedback, and dialogue between the teacher and the student; learner-content interaction is the methods by which students obtain intellectual knowledge from the material; learner-learner interaction is the exchange of information, ideas, and dialogue that occur among the learners regarding the materials or the course in general; and learner-interface interaction, which refers to the medium and technologies that are being used to deliver the online course. In addition to categorizing interaction in web-based courses, Zhang (2003) stated that transactional distance in web-based courses can be measured according to the four types of interaction. Thus, she developed an
instrument to measure the transactional distance in web-based courses. She found that the strongest interaction type that influences perceived transactional distance and engagement with learning is the student-student interaction, followed by the student-teacher, then the student-content interaction, and lastly the student-interface interaction.

In 2015, Paul, Swart, Zhang, & MacLeod (2015) revised Zhang’s scale. According to the massive changes in the recent online learning, Paul et al. (2015) removed and/or modified some items under each sub-construct (student-teacher, student-student, student-content and student-interface interactions). The sub-construct which got the most items removed or modified is the student-interface interaction (75% of its items), student-student interaction (55%), student-content interaction (50%), and the student-teacher interaction (33%). Regarding the influence on the perceived transactional distance, Zhang (2003) found student-student interaction is the most important indicator for perceived transactional distance and engagement with learning, Paul et al. (2015) found that student-teacher is the type of interaction that most influences the perceived transactional distance. Even though the student-interface interaction received the most modifications, both studies found that this type of interaction has the least influence on the perceived transactional distance. However, despite the developments in technology, the human interactions (student-student and student-teacher interactions) are still the biggest influencers in the online learning environments. Consistent with these two studies (Paul et al., 2015; Zhang, 2003), Giossos, Koutsouba, & Mavroidis (2016) focused on learner-teacher interaction. They developed a multidimensional scale for measuring perceived learner–teacher transactional distance. The final proposed scale has two dimensions; The co-understanding dimension includes statements such as “my teacher
knows that I need help in my studies,” “I need to communicate with her/him and the other students regularly,” “I need encouragement,” and “my teacher knows my opinion about the course module s/he teaches”. Whereas the awareness dimension includes items like “my teacher takes into consideration the knowledge I have,” “the abilities I have,” “the questions I have,” “the need I have for guidance and help in my studies,” and “the time I have available for study is limited.”

Usually, online courses are hosted in learning management systems (LMSs). Therefore, it is expected to see studies investigating issues related to LMSs. Chou, Peng, & Chang (2010) tested the interactivity of six different learning management systems (LMSs). The results indicated that the highest percentage of interactive functions in these six LMSs were related to human interactions (learner-learner interaction and learner-instructor interaction). This finding supports Paul et al. (2015) and Zhang (2003) in this regard. However, Chou et al. (2010) found that learner-content interaction had the lowest percentage of interactive functions in the LMSs. Further, Merrills (2010) analyzed the application of communication tools and strategies used by students in LMSs and explored how they perceive communication in their online courses. Results from this study revealed that students depended primarily on written, online communication tools that include emails, discussions, and class notes. Also, the results showed that more advanced communication tools, such voice threads, video presentations, live conferences, and demonstrations, were less likely to be utilized by participants in these online courses.

Regarding the educational technology McIsaac & Gunawardena (2004) noted that the interaction between the learner and the technology that delivers instruction is a critical component of any program. Hoskins (2012) concluded that the recent educational
technologies can provide several advantages for distance education. It stated that technology not only enhances the social aspect (learner-instructor and learner-learner interactions) but also, it enhances learner-content and learner-interface interactions by providing the rich multimedia environment. Nwankwo (2013) specified some technologies that improve the interactivity in online courses. These technologies include different methods of delivering content to the learner such as audio, video, graphics, animation, simulations in addition to text. Therefore, McIsaac, & Gunawardena (2004), Hoskins (2012), and Nwankwo (2013) emphasized the importance of educational technology in improving students’ engagement, achievements, satisfaction, and retention.

McBrien, Jones, & Cheng (2009) explored the role of a virtual classroom in distance education and analyzed the ways in which a synchronous learning environment affects students’ learning experiences. Students shared their positive experiences of participating in the synchronous virtual classroom. Students perceived that this online system increased the amount of social interaction among students and with the instructor. Moreover, many students linked the benefits of this interaction method with pedagogical considerations such as increasing discussion participation rate and providing opportunities for students to address their opinions and reflect on their learning. However, this study did not mention how the synchronous classroom worked with the online courses that have high enrollment and students from other states and/or countries with different time zones.

In another study, Wikeley & Muschamp (2004) used the example of a Doctor in Education (EdD) program to explore the implications of using virtual learning environments to enable students at a distance to participate in the program. This study
concluded that to lower transactional distance, increasing the dialogue is more useful than loosening the structure of online courses. This conclusion related to a controversial issue within transactional distance and the factors related to it. The next sections of this review will address this issue.

**Course Structure**

The second factor that influences transactional distance in distance education is course structure. According to Moore, (1993), course structure has an inverse relationship with transactional distance. It is important to clarify some specific terms regarding course structure. McBrien et al. (2009) indicated that terms such as course rigidity and flexibility were complex to understand. In fact, participants in this study responded well when “course rigidity and/or flexibility” were replaced by other terms such as clear, tight, and transparent. To address course structure identity, Jung (2001) reviewed the literature of web-based learning. This study stated that course structure in web-based learning has three elements. The key elements of this structure are (1) expandability of the content to other sources on the internet, (2) content adaptability according to learners’ context, needs, abilities, and (3) visual layout that includes accessibility, interactivity, and attractiveness of the web interface. These three elements provide the flexibility and adaptability for web-based learning. According to Jung (2001) course structure is reflected in the organization, content, and the delivery system. Huang, Chandra, DePaolo, Cribbs, & Simmons (2015) agreed with this orientation and indicated that content-learner and interface-learner interactions are related to the course structure. Thus, flexibility in online courses can be represented in individualization, variety, and formality of course content. Also, it indicated that interface-learner interaction can be enhanced by taking an
appropriate decision regarding choice of media use, usability, visualization, and functionality within interface technology. However, Sandoe (2005) produced an instrument that measures the structural component in the online learning environments. The instrument includes eight sub-constructs; content organization, syllabus, course schedule, delivery organization, consistency, flexibility, and two sub-constructs related to course interactions (student-student and student-instructor interactions). In fact, this instrument provides an overview of the structure component of the online learning environments.

Although the researchers in distance education have an agreement regarding the existence of transactional distance, there is no consensus among them about the nature of the relationship between course structure and transactional distance and between course structure and other factors (dialogue and learner autonomy). While Saba & Shearer (1994), Saba (2002), Moore & Kearsley (2005), Murphy & Rodriguez-Manzanares (2008), and Goel et al. (2012) support the Transactional Distance Theory as it is constructed by Moore (1993), other studies found that, in some circumstances, high structure can help to reduce the perceived transactional distance in online courses. For example, Nordin, Norman, Embi, Mansor, & Idris (2016) indicated that although high structured instructions could be a problem for higher-order thinking in advanced courses, it could be the best choice for introductory courses that required lower-order thinking. However, Jung (2006) stated that the association between the three factors and transactional distance is ambiguous. Moreover, participants in McBrien et al. (2009) struggled with online courses that are less structured, they indicated the need for clear, consistent, and organized structure.
In an exploratory comparison study, Al-Harthi (2010) investigated learners’ preferences from different cultures regarding two transactional distance components (Structure, Interaction). In this study, course structure was measured by the flexibility or rigidity of course objectives, choice of readings, course requirements, and deadlines of assignments. Whereas, the interaction was measured by student-instructor interaction and student-student interaction. One student group preferred highly structured courses with high interactions with instructors and other students. In this case, a high structure with high interaction enabled students in this group to have higher uncertainty avoidance, therefore, tended to perceive low transactional distance.

The findings from this study consistent with Benson & Samarawickrema, (2009), Forte (2015), and Huang, Chandra, DePaolo, & Simmons (2016) on that high course structure and high amount of interactions effectively reduce the perceived transactional distance in online learning environments. In this regard, Blue (2015) reported that the panel of experts in his Delphi study reached consensus on a statement indicating a workable balance between dialogue, course structure, autonomy for learners, and quality instructional design reduces the transactional distance.

Joo, Andrés, & Shearer (2014) provided empirical evidence when they redesigned an online course with a high level of the structure. This revision had a positive impact on dialogue, which made students perceive less transactional distance. Further, the revision had a positive impact on students’ learning outcome in terms of academic performance and learning engagement. The results from this study might contradict the assumption of Transactional Distance Theory, which indicates a positive correlation between course structure and perceived transactional distance and dialogue in a distance education course.
In this situation, the transactional distance was reduced by the high structure and high dialogue.

Larkin & Jamieson-Proctor (2015) examined the impact of redesigning an online mathematics education course according to transactional distance components. The participants were teaching students in a teacher preparation program. The findings indicated that the thoughtful integration of Web 2.0 technologies, provided high levels of structure and dialogue which led to minimizing the perceived transactional distance between teachers and students. Moreover, participants indicated that their attitude towards the subject matter and pedagogical content knowledge was improved as a learning outcome. This agrees with Wikeley & Muschamp’s (2004) conclusion that stated increasing the dialogue is more useful than loosening the structure of online courses to lower perceived transactional distance.

Dron (2005) criticized the inverse relationship between dialogue and structure in Transactional Distance Theory. Therefore, they developed highly structure a web-based course that includes high dialogue with more autonomy for learners. Students in that course perceived a low level of transactional distance and more control on their learning process. Deng & Yuen (2009) discussed the ideal compilation of transactional distance factors. Stated that incorporating transactional distance factors (structure, dialogue, and learner autonomy) should not be an either-or situation, rather, dialogue, course structure, and learner autonomy must be adjusted based on learning objectives, pedagogical needs, and student characteristics.
Learner Autonomy

The third factor in distance education is learner autonomy. According to Moore (1993), learner autonomy has an inverse relationship with course structure. However, Moore (1993) proposed that in distance courses that have high transactional distance, learners should possess a high level of autonomy. Like with course structure, there is no consensus between researchers in distance education about the nature of the relationship between learner autonomy and transactional distance and between learner autonomy and other factors (dialogue and course structure).

There are a set of studies that contradict the relationship between autonomy and course structure as proposed by Moore (1993). Burgess (2006) addressed the relationship of learner autonomy with student perception of instructor-student interaction and students’ satisfaction in their online courses. He found that there is a positive relationship between learner autonomy and student perception of student-instructor interaction. Students who reported a high level of autonomy indicated that they still need feedback and support from their instructor. The findings of Burgess (2006) supported the construct of the Transactional Distance Theory. However, Vasiloudis, Koutsouba, Giossos, & Mavroidis (2015) assessed the relation between autonomy and transactional distance throughout an academic year. Results indicated that the transactional distance gets lower as the academic year is going on. The assessment of learner autonomy revealed that students have higher values in autonomy in terms of managing new situations and self-awareness. Also, it showed that students have developed sensitivity to other students as the academic year is going on. However, the results found that the relation between transactional distance and learner autonomy is very limited. That means the results of this
study did not prove the relationship between transactional distance and autonomy as it is indicated in Moore’s theory.

Regarding the relationship between learner autonomy and other transactional distance factors (dialogue and course structure), Andrade (2014) investigated Self-Regulated Learning (learner autonomy) within online courses that can be improved by structure and interaction. This study stated that SRL has six dimensions, goal settings, learning materials selection, use of time, determining a physical environment, establishing social environment, and performance in workload. Also, it suggested that SRL dimensions should be embedded in online course structure and interaction plans at an early stage of any distance education program so that online students become aware of this dimension.

**Transactional Distance Theory within Distance Education**

The previous part of this review is focused on the functions of the three factors that influence transactional distance. Gokool-Ramdoo (2008) stated that the reluctance to recognize Transactional Distance Theory as a global theory has inhibited distance education development; which puts distance education in a theoretical dilemma. Therefore, they suggested that research in distance education should move forward to a practice phase. Thus, the purpose of this section is to highlight some other variables that may influence transactional distance. These variables may or may not be related to one of the three main factors (dialogue, course structure, and learner autonomy).
Park (2011) identified four types of distance education that address transactional distance. Distance education types were divided according to their individual or social context. The four distance education types were as follows. 1) High transactional distance socialized: the learning process mainly occurs among learners with minimal involvement from the instructor who facilitates the learning process and the group activity. 2) High transactional distance individualized: in this type the learning takes place when the individual learner interacts with the content. This type of distance education allows greater flexibility and portability. 3) Low transactional distance socialized: in this type, a group of learners work together to achieve a common goal. This type engages learners in social interaction, negotiation, and frequent communication. 4) Low transactional distance individualized: this type enables the individual online learner to interact directly with the instructor. However, the instructor controls the learning experience. Although these categories represent transactional distance in some perspectives, the relationship between transactional distance components is neither comprehensive nor clear throughout the categories.

Hauser, Paul, & Bradley (2012) compared the transactional distance in both online and face-to-face mediums. The findings highlight the importance of the interactive or emotive characteristics of transactional distance in the face-to-face medium, while the structure and student autonomy aspects were more influential in the online medium. However, this study emphasized using new technologies and strategies to improve the interaction aspect of online learning environments. Later, Laux, Luse, & Mennecke (2016) examined a model that measures the factors that significantly influence a student's persistence in a virtual collaborative learning environment. The results indicated that
online programs that establish learning communities where the collaborative learning takes place, provide a greater sense of connectedness for students. Which influences students’ persistence within online learning environments.

In an empirical study, Kenyon (2012) examined the effects of a higher level of course interactivity on learner performance and satisfaction. Participants in this study were divided into two groups; limited interaction and complex interaction. Although results from this study revealed no significant differences between low interaction and complex interaction groups regarding student satisfaction, it found the complex interaction group gained significantly greater pre- and post-test scores in course content than the low interaction group. In another study, Mbwesa (2014) studied the relationship between students’ satisfaction and transactional distance. This study examined learner-learner, learner-teacher, and learner-content transactional distance as predictors of perceived learners’ satisfaction. Results of this study indicated that the three types of transactional distance (learner-learner, learner-teacher, and learner content) had a significant association with students’ perceived satisfaction. In fact, the three predictors explained 31.6% of the variance of students’ satisfaction. According to Cohen (1988), this is a large effect in social sciences. Findings from this study consistent with Burgess (2006) that online student satisfaction highly correlated with course interactions. Further, Riggins (2014) concluded that sufficient students’ interaction provides a deep learning experience. Also, the results agree with Stein, Wanstreet, Calvin, Overtoom, & Wheaton (2005) that online student satisfaction highly correlated with course structure and interactions.
Some studies hypothesized that there were variables that may influence transactional distance other than interaction, course structure, and learner autonomy. In this regard, Chen (2001) aimed to measure the impact of learner’s skill level with the internet, previous experience in taking distance education courses, the extent of interaction, and types of learner support on perceived transactional distance in an online learning environment. It was found that both the learner’s skill level with the internet and the extent of the interaction that occurred between instructor and learners and among learners did have statistically negative effects on perceived transactional distance. Although Chen (2001) did not find a significant impact of the previous experience with distance education on perceived transactional distance, House, Weldon, & Wysocki (2007) found a negative relationship between perceived transactional distance and the number of online courses that a student has taken. That means students with more experience in an online learning environment tend to have less perceived transactional distance compared to a student with less experience.

Moreover, Rovai (2000) discussed the factors that influence building and sustaining community in asynchronous learning networks. He mentioned some factors that help to build a sense of community in synchronous learning environments. Besides variables related interactivity, Rovai (2000) mentioned student–instructor ratio as a variable that may have an influence on transactional distance in online learning environments. Further, Stein et al. (2009) identified three factors that help the online learner to perceive less transactional distance. The identified factors were; self-presence and reflection, interactive learning community and time for learning. According to the previous four studies, studying transactional distance according to specific variables such as student
technological skills (Chen, 2001), student experience with online learning (House et al., 2007), student-instructor ratio (Rovai, 2000) and time allocated for online studying (Stein et al., 2009) helps to provide an operational understanding for the transactional distance.

**Instructional Design Aspects in Online Courses**

This part of the review focuses on the pedagogical and practical aspects of instructional design in online learning, particularly, aspects that help to reduce transactional distance. Bento, Li, Gross, Pallett, & Webster (2013) investigated the factors that make a course more likely to be successful in an online learning environment. Participants indicated that designing the online learning experience, and providing a good amount of autonomy for the learners are the factors that make online courses successful. In addition, this study stated that soft and applied courses are more appropriate for online delivery. Further, Steinman (2007) concluded that in order to build an effective educational experience through online learning, a distance program should shift from one-way vertical to interactive horizontal relationships between instructor and learners.

Researchers in distance education utilized different conceptual frameworks to develop models and practices for online instructional design. Wold (2011) proposes instructional design practices using a combination of the cognitive load, activity, sociocultural, and transactional distance theories. According to Wold (2011), all four theories emphasized that the course structure should include space to address goals and learning objectives and space for students to ask questions regarding specific information or general issues. In addition, she recommended instructional designers to recognize learning context including learner characteristics and learners’ preference. Joo et al.
(2014) provides more details regarding online courses structure. This study stated that online learning in the higher education context is highly dependent on course structure that includes developing modules, lessons, content materials, assignments, delivery methods, interaction plan, and assessments. Researchers in this study agree with Wold (2011) that the instructional designer should be informed about learners’ characteristics and program context.

In order to address interactivity in an online learning environment, Yates (2014) identified the extent to which a series of synchronous online webinars impacting the nature of participants’ interactions and their learning. The participants described the instruction as engaging and relevant. Although participants indicated that this online medium reduces learner-learner interaction, they stated that learner-instructor remained strong, which saved the learning experience. Also, they mentioned the schedule of the webinars as one of the success factors for the learning process. In another study, Yilmaz & Keser (2017) studied the impact of the interactive environment and metacognitive support in online learning on academic achievement and transactional distance. This study did not find any significant difference between asynchronous environments that supported by metacognitive and interactive synchronous environments in terms of students’ achievements. That indicates asynchronous delivery can work effectively when providing the appropriate support. Pettazzoni (2008) examined the relationship between student’s environment in an online course and their academic achievement within transactional distance theory components. She found a significant positive relationship between interaction and students’ achievement. That suggests an inverse relationship between transactional distance and students’ achievements.
It is common for many institutions are using learning management systems (LMSs) to deliver their online courses. Smith, Heindel, & Torres-Ayala, (2008) utilized LMS tool usage logs and course evaluations to analyze differences between online courses in disciplinary quadrants (hard-pure, hard-applied, soft-pure, soft-applied). The results revealed significant differences between disciplines in tool usage. For example, the assessment tool’s hard-pure courses used exams, tests, and quizzes more often than did soft-pure courses. Whereas, the document tool was used most in applied courses. However, analysis of course evaluations revealed that applied disciplines had a lower learner-instructor transactional distance than did pure disciplines. In order to identify the most used and important functions in LMSs, Chou et al. (2010) explored six different LMSs. The results indicated that online students considered the function of “assignment handling” to be the most frequently used and useful function. In addition, students addressed the importance of any functions that would help them monitor or track their learning progress within the online learning environment. However, participants in this study required more student-content interaction functions to be available in LMSs. Consistently, Ustati, & Hassan (2013) found that the most used functions are assignment submissions, accessing course content, and receiving feedback from instructors. Participants hoped for more interactivity with other learners.

Seeking improvements in online learning design, Garthwait (2014) employed a learning-style inventory of online students to draw a clear vision toward future planning for online programs. In this study, the students indicated that un-updated materials and inaccessible links as distractions in online courses. Likewise, Levene & Seabury (2014) and Mbwesa (2014) found that interface usability and content accessibility are common
features that online learning evaluators focused on. They recommended that in order to produce online learning with low transactional distance, instructional designers should pay careful attention to usability and accessibility within online learning environments.

Online learning design not only relates to the technology but also, relates to how online instructors are using this technology. In this regard, Kanuka (2001) investigated students’ concerns about web-based learning in higher education programs. The findings indicated that the students’ biggest concerns with online learning were a lack of timely and adequate feedback, working with instructors without expertise in the online learning technologies, and confusing instruction sequence. Participants in Garthwait (2014) also mentioned instruction sequence as an important player in the effectiveness of online courses.

In an empirical research study, Wallace, Grinnell, Carey, & Carey (2006) examined the impact of two different online feedback strategies on students’ achievement and perceived transactional distance. Learners were randomly assigned to one of two treatments. In the first treatment, practice tests with correct answers displayed for comparison. In the second treatment, interactive practice tests with computer-generated feedback according to students’ performance with the percentage of correct answers were included. The results showed that learners who were assigned to interactive practice tests with computer-generated feedback performed significantly better on the final examination. Although the interactive practice test had higher structure, students’ perceived low transactional distance with this treatment.
In an exploratory study, Mathieson (2012) explored students’ perceptions of audiovisual feedback provided via screen casting as a supplement to text-only feedback. Although participants in this study appreciated the timely text-only feedback, they indicated that text-audiovisual feedback as more effective in terms of learning outcomes and building the learning community. Further, learners considered text-audiovisual as more “real” and “personal” than text-only feedback. However, this study stated that providing text-audiovisual took twice as long as providing text-only feedback, so, it may not be feasible for online courses with large enrollments. Therefore, the study concluded with a recommendation that rather than recording screencasts for each student individually, the instructor may choose to record one screencast that summarizes feedback for the whole class.

Discussion board or thread is an interactive option that is available for online instructors to use. Maurino (2007) investigated the effectiveness of the discussion threads within online courses. She found that online learners tended to participate more in graded discussions. However, she indicated that without instructors’ involvement and encouragement, discussions do not normally rise to a higher level. Thus, Maurino (2007) recommended that online instructors must be active in the discussion threads and post deep, explanatory, and reflective questions. Furthermore, Wold (2011) encouraged instructors to design discussions and assignments where the learner can address their own experiences to enhance learners' self-confidence.

Web 2.0 tools are options that can provide interactivity in online courses. Mbatha (2014) reported on the pedagogical value that Web 2.0 tools provide for online learning. Participants in this study have positive perceptions toward tools such as social networks,
podcasts, blogs, wikis, shared documents, YouTube, and multimedia sharing. They stated that these tools enhance the learning process in online learning environments. In terms of the educational benefits of Web 2.0 tools, participants recognized collaboration, self-publishing platform, evolving content, and dynamic content as the most important benefits. However, participants did not agree that modularity, convergence, user control provide educational benefit within Web 2.0 tools. In regards to this, Dron (2007) discussed social software, such as blogs, wikis and collaborative filters, and threads as interaction methods for long-life learners within online environments. Dron (2007) also suggests that the features of social software can facilitate a quality approach to e-learning. Not only in terms of learner-learner interaction but also, learner-teacher interaction and learner-content interaction as well. Using video has become a common tool in online learning environments. Nordin et al. (2016) identified two types of video that can be used with online learning (animation videos and live action videos). In this regard, Guo, Kim, & Rubin (2014) discovered that the use of instructor-talking-heads is more engaging to online students than displaying only powerpoint slides in the videos. However, Deng, & Yuen (2009) explored the practices and issues that are related to technology in higher education. They indicated that educators who are interested in incorporating technology into teaching and learning should first address the pedagogical rationale for their use. This will ensure the meaningful and purposeful implementation of the educational process.

This review highlights important aspects of online instructional design that online educators should be aware of. These aspects include the types of the course that we want to deliver it online (hard-pure, hard-applied, soft-pure, or soft-applied discipline), the
interactive horizontal relationship between instructors and students, design goals and objectives, modules, lessons, accessible and usable content material, assignments, delivery methods and interaction, and assessment plans. All these aspects should be developed according to learners’ characteristics and program context. Also, the literature emphasizes the importance of using technology that provides pedagogical benefits for online instruction.

**Web-Based Education in Agricultural Education**

Online courses have become more popular in agricultural education. Several agricultural education departments around the United States are offering online courses for their students, as well as a variety of programs that are provided entirely online. Roberts & Dyer (2005) identified five dimensions for research in agriculture distance education: 1) the practices of distance education, 2) the demand and support for distance education, 3) faculty related variables, 4) motivating factors, and 5) barriers to distance education.

Researchers within agricultural education have done many studies in order to explore and improve the practices in agriculture web-based courses. Miller (1997) investigated the learning strategies used by students enrolled in videotaped courses. The results indicated that the distant learners preferred to study independently and learned by watching the instructional videos, reading assigned materials and notes, and completing assignments. Also, the results showed the high level of autonomy that students possess. So, they rarely studied with other students and rarely called the instructor. Moreover, Boyd, & Murphrey (2001) identified important considerations regarding instructional design from the students’ perspective. Participants indicated that rich-multimedia aspects
(audio, video, and graphics) are important in an online learning environment. Also, participants indicated weekly modules are important to limit the time spend on the assignments and the material. From a student’s standpoint, regularly scheduled meetings with the instructor and other students is important to reduce transactional distance. Murphrey, Arnold, Foster, & Degenhart (2012) measured the influence of an audio/video communication tool (JingTM) in the online classroom environment. Participants reported a strong preference for getting feedback via this communication tool because it improved the social presence, interaction, and immediacy. Kuna (2012) found that discussion board and content management tools were most useful and most frequently used in online learning management systems. However, participants mentioned that even they use e-mail to communicate with the instructor or other students, they do not believe it is a learning tool. In general, Menalled, Grimberg, & Jones (2009) concluded that flexibility and interactivity in the online learning environments encourage learners to participate actively whether the delivery system is synchronous or asynchronous. Even though participants in House, Weldon, and Wysocki (2007) reported lower expectation regarding their learning ability in online courses, they indicated that online courses provide a flexible learning experience. Therefore, House et al. (2007) suggested that in order to improve the learning process, online course developers should find a balance between interaction and structure in online courses.

Some studies focus on the impact of distance education on students’ achievement and learning outcomes. McCann (2006) investigated the relationship between learning styles and learners’ performance in three types of learning environments; traditional instruction, online instruction with minimal interaction, and online instruction with rich
multimedia. The results showed that learners in rich-multimedia online instruction had statistically higher scores on a post-test than learners in the other learning environments. In a qualitative study, Conner et al. (2014) found the quality and the structure of online learning motivated students to engage in the learning experiences. Further, students stated that online learning enables them to work at their own pace; which gave them time to improve their learning outcomes.

Measuring students’ satisfaction with an educational strategy or type is a common way to assess the success of that strategy or type. In this regard, Strong, Irby, Wynn, & McClure (2012) assessed students’ perceptions of the learning environment, social presence, and satisfaction in online courses. The findings revealed that learning environment and social presence had significant effects on students’ satisfaction. In this study, learning environment and social presence explained 26% of the variance in students’ satisfaction in online courses. Thus, Strong et al. (2012) suggested that including social media tools in online learning, may improve social presence. In addition, this study stated that developing assignments that enhance collaboration among learners will improve students’ social presence, the learning environment and student satisfaction in online courses. Kelsey, Lindner, & Dooley (2002) sought the same objective with graduate students in a distance program. Learners were satisfied with the instructional design, instructors, and group collaboration. However, learners were not satisfied with transactional distance, resources and materials accessibility, lack of offered courses, and technology problems. Mink & Moore (2005) explored students’ perceptions regarding the distance degree program available in the College of Agricultural and Life Sciences at the University of Idaho. Participants indicated that factors such as family and job
responsibilities and flexibility of distance classes influenced the decision to complete the
distance degree program. Regarding the academic programs, students were satisfied with
academic preparation, class delivery methods, academic advising, and the overall quality
of education. On the other hand, students were less satisfied with the variety and the
number of courses offered.

Interaction in agriculture online courses earned more attention from researchers.
Although some studies indicated that students prefer more interaction in their online
courses and it is important to improve their learning outcomes, other studies found that
online students do not prefer much interaction in their courses. Miller (2015) analyzed
student interaction and achievement in an online research methods course for students
majoring in agricultural education and related disciplines. Students’ interaction was
measured by the following metrics, total time in minutes, discussions read, and content
files viewed. The results revealed that there are positive correlations between interactions
and students’ achievement in terms of final grade. In addition, Kelsey, Hong, & Dvorak
(2011) explored learners’ perceptions regarding the educational benefit of using wikis to
create an online textbook in a graduate agricultural adult education course. Learners
stated this experience enhanced their learning in terms of knowledge construction and
critical thinking skills. Also, participants indicated that this supported student-student
interactivity within the course.

Conversely, Moore, Warner, & Jones (2016) sought to determine if there are
differences in professors and students’ perceptions regarding student-to-student
interaction in online courses. Although some students indicated the importance of
student-student interaction, the majority of the students did not like or want student-to-
student interaction in online courses. In the same study professors’ perceptions were significantly different. Professors believed the students desired student-to-student interaction. Also, professors thought that students understood the importance of this kind of interaction for their learning progress. Moore et al. (2016) conducted a similar study that only included the graduate students in Agricultural Education. It indicated the same results of students’ perceptions regarding student-student interaction. Course interaction is not the only aspect on which the professors and students had different perceptions. Murphy (2002) examined the advantages and usefulness of course websites. Again, professors and students did not have the same perceptions regarding the advantages of course websites. Students perceived course websites as beneficial tools more that professors did. Furthermore, professors and students did not agree on the usefulness of the material on these websites.

Comparing online courses to traditional on-campus courses is a major pattern in the research of agriculture distance education. Koch, Townsend, & Dooley (2005) compared distance courses to traditional courses in agriculture leadership education. This study found no significant differences between students in the traditional and distance education in students’ scores on five different leadership scales. Therefore, this study concluded that at the graduate level, leadership education courses can be taught in online environments as effectively as traditional face-to-face courses. Also, Benson et al. (2005) compared the effectiveness of distance courses to traditional face-to-face courses in Agriculture Career and Technical Education. Benson et al. (2005) investigated how online and campus-based courses differ in terms of course interaction, content organization, and transactional distance. This study did not find any significant difference
between online and on-campus students in course interaction and course organization. While online students stated that they are “close” to the instructor and the program, on-campus students stated that they are “very close” to the instructor and the program. However, there was no significant difference between online and on-campus students on perceived transactional distance. Also, this study did not find a significant difference between online and on-campus students on their academic performance. Roberts (2006) tried to identify differences that can exist between students in an introductory food science course in different learning environments (distance vs face-to-face). The results indicated no significant differences between students in terms of learning experience with the course content. Therefore, this study agrees with Koch et al. (2005), Benson et al. (2005), and Moriba & Edwards (2013) that online courses can provide a learning experience as effective as on-campus courses.

Although most of the conducted studies related to the practice of distance education in agriculture colleges, there are some studies related to other dimensions of research in agriculture distance education. Researchers in this field sought input from educators in agricultural education regarding distance education. Born & Miller (1999) investigated the perceptions of Iowa State University Department of Agronomy faculty regarding web-based courses in the Agronomy Distance Education Program. Findings showed that faculty had higher perceptions when they were familiar with the program or had been involved in the program. However, the largest concerns of the faculty focused on the value of online degrees, the effectiveness of student-instructor interaction, and the strictness of web-based distance education. Further, Gammill & Newman (2005) stated that the success of online courses depends on the nature of course content. Moreover,
Gammill and Newman (2005) found that a lack of coordination and support, limitation of development and revision time, technical problems, and lack of incentives for teaching online are obstacles for online learning environments.

Swan, Jackman, & Grubbs (2005) identified the preferred method of distance delivery for additional education or training opportunities and determined the subject areas most desired by agricultural CTE educators. The distance education methods viewed most favorably are videotapes and the internet. Regarding the topics and subject areas, educators stated their desires to learn about agriculture technology, plant and animal sciences, and educational technology. The findings of Swan et al. (2005) and Schmidt, Miller, & Carter (2005) are identical regarding the internet as the most favorable method to deliver agricultural distance courses. Also, they mentioned the same topics of interest. Further, Bjelland & Miller (2014) identified specific professional development needs of instructors relative to teaching, advising, and recruiting students in two online programs offered by the College of Agricultural and Life Sciences at Iowa State University. Participants in this study indicated their desire to learn strategies and techniques to increase students’ interaction in online courses. However, they mentioned time as a significant barrier to their professional development.

Harder, Zelaya, & Roberts (2016) explored extension agents’ perceptions regarding an online professional development program. Participants indicated that the online modules allowed more flexibility to complete the learning tasks according to their schedules. Therefore, students could decide where and when the learning would take place. However, the participants stated that the assignment communication was unclear. Some of them stated that they were confused about the directions for assignment
completion. Others mentioned that it was difficult for them to find the appropriate information to help complete the assignments. Regarding the type of information that they need, participants mentioned that they need more practical information than the online modules provided. They found the information presented in the modules was theoretical. Therefore, it was difficult for them to apply what they have learned to their daily practices.

The literature of agriculture distance education has different patterns. Some patterns that showed in this review are distance education practices, students’ achievements, and satisfaction, interaction in agriculture online courses, the comparison between online and traditional courses, and professional development needed for agriculture educators regarding distance education. Regarding this pattern, Strong et al. (2012) stated that in order to increase the effectiveness of online courses, agriculture online courses should be routinely evaluated and identify potential improvements in online learning environments.

According to their finding, in general the studies that used the Transactional Distance Theory as a framework can be divided into two groups. The first group supports the Transactional Distance Theory as it is published in Moore (1993). This group includes studies that indicated that the relationship between course structure and transactional distance is positive. That means more structure the more transactional distance between learners and their online courses. Also, this group includes studies that indicated that the relationship between course structure and interaction is negative. Which means the more structured an online course is, the less interaction that online course involves. Saba & Shearer (1994), Saba (2002), Moore & Kearsley (2005) Murphy &
Rodriguez-Manzanares (2008), and Goel et al. (2012) are examples of studies that support Moore’s theory as shown in Figure 1.

Figure 1. *The relationship between factors influence transactional distance.*

The second group includes studies that indicated alternative relationships between course structure, course interactions, and transactional distance. Several studies in this group indicated that the relationship between course structure and transactional distance is negative. That means more structure helps to reduce transactional distance between learners and their online courses. Table 1 summarizes the findings of some studies in this group.
Table 1

**Summary of the findings of studies that indicate alternative relationships between the transactional distance factors**

<table>
<thead>
<tr>
<th>Study</th>
<th>Findings regarding transactional distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jung (2006)</td>
<td>Stated that the association between course structure, interaction, and transactional distance is ambiguous.</td>
</tr>
<tr>
<td>Nordin et al. (2016)</td>
<td>Indicated that highly structured instruction is appropriate for introductory courses that required lower-order thinking. Also, they mentioned that high structure could be a problem for higher-order thinking in advanced courses.</td>
</tr>
<tr>
<td>McBrien et al. (2009)</td>
<td>Found that students struggle and feel more transactional distance with online course that are less structured.</td>
</tr>
<tr>
<td>Al-Harthi (2010)</td>
<td>Indicated that online students prefer to avoid uncertainty. Thus, they prefer highly structured courses with a high amount of interaction with the instructor and other students.</td>
</tr>
<tr>
<td>Benson &amp; Samarawickrema (2009)</td>
<td>High course structure and high amounts of interactions effectively reduce the perceived transactional distance in online learning environment.</td>
</tr>
<tr>
<td>Forte (2015)</td>
<td></td>
</tr>
<tr>
<td>Huang et al. (2016)</td>
<td></td>
</tr>
</tbody>
</table>

Research in both groups studied transactional distance in online courses using course structure or interaction to study transactional distance. This study is more comprehensive because it considers all three factors that influence transactional distance (course structure, interaction, and learner autonomy), as well as instructional design practices that may help to reduce transactional distance in online leaning.
CHAPTER 3: METHODOLOGY

Research Design

The purpose of this study was to describe relationships between factors that influence perceived transactional distance (course structure, course interaction, and learner autonomy) and instructional design aspects that may help to reduce transactional distance from the learner's perspective.

A descriptive survey research design was used. An online questionnaire was used for gathering data related to the research objectives. Several steps were taken to improve validity of the study. The greatest threat to internal validity was measurement error. To address this threat several steps were taken to produce valid and reliable measures. A panel of experts was used to improve face, content, and construct validities. External validity was improved by selecting all online graduate students who registered in fall 2017 (eliminating biased selection) and comparing the early responses with late responses to ensure that the participants are representing the population.

Subjects/Data Source

The population for the study consisted of all graduate students who enrolled in online courses in the College of Agriculture and Life Sciences (CALS) at Iowa State University during the fall semester of 2017. There were 271 graduate students enrolled in six different online programs in the CALS; M.S. in Agronomy, M.S. in Agricultural Education, M.S. in Seed Technology and Business, M.S. in Plant Breeding, M.S. Agricultural Business and International Agriculture, and Graduate Certificate in Food Safety & Defense. Students in these programs were registered in a total of 27 online courses.
Agricultural Education Courses

AGEDS 511: Professional Agricultural Presentation Practices.
AGEDS 524: Program Development and Evaluation in Agricultural and Extension Education.
AGEDS 550: Foundations of Agricultural Education.
AGEDS 561: Technology Transfer and the Role of Agricultural and Extension Education.
AGEDS 568X: Qualitative Interviews and Analysis.

Agronomy and Plant Breeding Courses

AGRON 501: Crop Growth and Development.*
AGRON 502: Chemistry, Physics, and Biology of Soils.
AGRON 503: Climate and Crop Growth.
AGRON 506: Crop Genetics.*
AGRON 511: Crop Improvement.
AGRON 512: Soil-Plant Environment.
AGRON 513: Quantitative Methods for Agronomy.*
AGRON 514: Integrated Pest Management.
AGRON 524: Applied Plant Molecular Genetics & Biotechnology.*
AGRON 531: Crop Ecology and Management.
AGRON 532: Soil Management.
AGRON 533: Crop Protection.
AGRON 544: Host-Pest Interactions.*
AGRON 570: Risk Assessment for Food, Agriculture and Veterinary Medicine.
AGRON 592: Current Issues in Agronomy.

Food Science and Human Nutrition Courses

FS HN 523: A Multidisciplinary Overview of Food Safety and Security.
FS HN 525: Principles of HACCP.
FS HN 529: Foodborne Toxicants.

Seed Technology and Business

STB 510: Crop Improvement.
STB 536: Quantitative Methods for Seed.
STB 539: Seed Conditioning and Storage.
STB 543: Seed Physiology.

*Offered for both Agronomy and Plant Breeding. Appendix E provides a description for each online course.
Instrumentation

The instrument used in this study was developed to address the research objectives. The instrument was built according to Radhakrishna’s (2007) recommendations. He stated that developing a reliable and valid survey questionnaire should go through five steps:

Step 1 - Background Establishment: In this essential step, an understanding of the research context was developed. Also, the research purpose and objectives were formed according to gaps in the literature.

Step 2 - Questionnaire Conceptualization: In this step, the research was linked to a theoretical framework (Transactional Distance Theory). Also, this step includes determining the independent and the dependent variables. Constructs of the survey and items under each construct were adopted from previous studies and modified to match the research objectives. While items related to course dialogue were adopted from Zhang (2003), Horzum (2011), and Paul et al. (2015), items under the Course Structure construct were generated from Sandoe (2005), Congress (2015), and Blue (2015). Whereas statements related to learner autonomy were generated using Burgess (2006) and Blue (2015).

Step 3 - Format and Data Analysis: The focus of this step was on finalizing the statements, selecting appropriate scales of measurement, questionnaire layout, format and colors, question order, and font size. Also, in this step decisions were made regarding data analysis strategies to be used for this research. This step resulted in an online survey that contained five constructs (Appendix D).
The first construct was Perceived Distance. This construct asked the participants to indicate the distance that they felt from the instructor, the other online learners, the course content, the course website, and the course overall. A four-point Likert scale was used (1=very distant, 2= distant, 3= close, 4= very close) to describe learners’ perceived distance.

The second construct was Course Structure; the participants indicated their level of agreement with ten statements related to course structure based on their experience in the online course that they were taking during the current semester. This construct used a five-point scale (1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree) to describe their agreement.

The third construct was Course Interaction. This construct had four sub-constructs representing four different types of interaction in online learning environments (Student–Instructor Interaction, Student-Student Interaction, Student–Content Interaction, Student–Website Interaction). The participants were asked to indicate the frequency of interaction items based on their experience in the online course that they were taking during the fall semester. Learners used a five-point scale (1= never, 2= rarely, 3= sometimes, 4= often, 5= always) to describe the frequency of 27 interaction items.

Learner Autonomy was the fourth construct in the survey and consisted of seven items. Learners were asked to indicate their level of agreement with statements that describe them as online learners. This construct used a 5-Point Scale (1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree) to describe learners’ agreement.
The fifth construct was Instructional Design. It included 38 practices used in designing online courses. This construct consisted of two sub-constructs (inclusion and importance). Participants were required to respond to two columns. In column A, participants report if the instructional design items were included in the online course that they were taking. In column B, participants indicated the level of importance of the instructional design items to be included in the online courses. Regarding the importance column, participants used a four-point Likert scale (1= not important, 2= little importance, 3= moderate importance, 4= very important) to indicate their opinions regarding the importance of the instructional design items to be included.

The last section of the questionnaire was focused on demographic questions. Six questions regarding; gender, education level, employment status, student status, current major, and number of online courses taken.

Step 4 - Establishing Validity: Validity was established using input from two distance education experts in the CALS; Dr. Wade Miller, a faculty member in the Department of Agricultural and Studies and Dr. Gaylan Scofield, the director of Brenton Center. In their responses, they answered questions regarding content, construct, and face validity. Appendix A shows the guidelines that the experts used. The panel of experts concluded that the questionnaire was face, content, and construct valid. Based on recommendations from the panel of experts, clarifying information was added to the instructions in the introduction of each construct in the questionnaire.

Step 5 - Establishing Reliability: After obtaining approval from the Institutional Review Board (IRB) (Appendix B), a pilot study for the survey was conducted with graduate students who had taken at least one online course at ISU (n=20). Graduate
students received an invitation email to participate in the pilot in September 2017 (Appendix C). The twenty graduate students who participated in the pilot test were not among the participants in the final data collection.

According to Radhakrishna (2007), the goal of the pilot study is to ensure that the questionnaire consistently measures whatever it designed to measure. A reliability analysis was performed to examine the internal consistency of the five constructs in the survey. Cronbach’s Alpha coefficients indicated an acceptable level of internal consistency for all scales (Table 2). The Cronbach’s Alphas ranged from 0.741 to 0.945. The reliability analysis revealed that alpha would not improve with the removal of any of the items from any scales.

Table 2

*Cronbach’s Alpha of the internal consistency of the five constructs in the survey.*

<table>
<thead>
<tr>
<th>Construct</th>
<th>N of Items</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part A</td>
<td>Perceived Distance</td>
<td>5</td>
</tr>
<tr>
<td>Part B</td>
<td>Course Structure</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Student – Instructor Interaction</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Student – Student Interaction</td>
<td>5</td>
</tr>
<tr>
<td>Part C</td>
<td>Student – Content Interaction</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Student – Website Interaction</td>
<td>8</td>
</tr>
<tr>
<td>Part D</td>
<td>Learner Autonomy</td>
<td>7</td>
</tr>
<tr>
<td>Part E</td>
<td>Instructional Design - Inclusion</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Instructional Design - Importance</td>
<td>38</td>
</tr>
</tbody>
</table>

*Data Collection*

The data collection process occurred on the Qualtrics platform. This program has built-in features for tracking and keeping records of those who completed the survey, thus allowing follow-up emails to be sent only for those who had not responded. A list of the online students who enrolled in agriculture online programs during the fall semester of
2017 was obtained from the Brenton Center for Agricultural Instruction and Technology Transfer.

The data collection started on September 28, 2017, by informing learners in the population about the study, its objectives, and the advantages of conducting such a study. The initial e-mail indicated that the participation was voluntary and the collected data would be reported in a gross format, thus protecting the identities of individual respondents. The participants were assured that this research has minimal risk and the data collected would be kept confidential. Also, the initial email informs the online students that the process of data collection would start in the following week. On October 2, 2017, a link to the survey was sent to the online students via email. After the first e-mail, the researcher sent three reminders to non-respondents (Oct. 9, Oct. 16, and Oct. 23) explaining that their response was important for this study. The open survey period ended on October 29, 2017, at 11:59 p.m. After the data collection process concluded, a drawing held for ten ($10) Starbucks gift cards. The gift cards were electronically purchased and sent to the winners through the Starbucks website.

By the end of the data collection process, 80 online students had responded to the survey. The survey consisted of six parts (perceived distance, course structure, course interactions, learner autonomy, instructional design items, and demographic characteristics). Because perceived distance, structure, interactions, and autonomy are the most important variables in the study, participants who failed to finish the first four parts in the survey were eliminated. Ten responses were eliminated. Thus, 70 responses were usable. Some participants did not respond to the last two constructs (learner characteristics and instructional design items). Therefore, the numbers of responses are
reported for results to account for missing data in the useable questionnaires. A final response rate of 26% (n=70) was obtained; respondents from the pilot study are not included.

**Non-Response Error**

The response rate for the study was relatively low (26%). Nulty (2008) found that the average response rate in online surveys is 33%. Nulty (2008) mentioned that low response rates may cause systematic bias in study results. Lindner, Murphy, and Briers (2001) addressed this issue regarding the low response rate. They indicated that comparing means of early to late respondents is an effective way to avoid biased results. This technique stated the low response rate impacts the research results if a means comparison test reveals a significant difference between early and late respondents regarding survey constructs. Therefore, the 70 online students were divided into two groups according to their response time. Since the data collection process took four weeks, early respondents were those who submitted their responses during the first two weeks (n=37). The late respondents were those who submitted their responses during the last two weeks (n=33). The Statistical Package for the Social Sciences (SPSS) was used to run a t-test for equality of means. There were no significant differences between early and late respondents on any of the survey constructs. That means the 70 online students who responded to the survey represent the population of the study.

**Data Analysis**

The collected data were exported from Qualtrics to the SPSS version 25.0. For the first research question, descriptive statistics were used to analyze and report online students’ demographic characteristics. While frequencies and percentages were used to analyze and report the data regarding gender, education level, student status, employment
status, and current major, means and standard deviations were used to analyze and report the data regarding the number of online courses taken.

The second research question, descriptive statistics were used to analyze and report online students’ perceptions regarding their perceived distance from their instructors, other online students, course content, and the course website. Means, standard deviations, frequencies, and percentages were used to analyze and report the data regarding learners’ perceived distance.

Third research question investigated the relationship between learners’ perceived distance and their demographic characteristics. Because of the nature of demographic variables (nominal variables), Cramer’s V was used to investigate the relationship between the students’ perceived distance from instructor, other online student's, course content, course website and the online course overall and students’ gender, educational level, academic major, employment and student status (ordinal variable). Also, because of positive skewness in the data, the Spearman rho was calculated to define the relationship between the students’ perceived distance and the number of online courses that students have taken (Morgan, Leech, Gloeckner, & Barrett, 2013).

Also, for the fourth research question, descriptive statistics were used to analyze and report online students’ perceptions regarding course structure, interaction, and learner autonomy. Means, standard deviations, frequencies, and percentages were used to analyze and report the data regarding factors that influence transactional distance in online learning environments.

According to the nature of the variables and the positive skewness in the data, the nonparametric Spearman correlation was used, in the fifth research objective; to define the
relationship between the students’ perceived distance and factors of transactional distance (dialogue, course structure, and learner autonomy). Moreover, a multiple-linear-regression was used to determine if students’ perceived distance could be predicted from the combination of course interaction, course structure, and learner autonomy (Morgan, Leech, Gloeckner, & Barrett, 2013).

The online students’ perceptions regarding instructional design aspects were analyzed and reported using descriptive statistics. While, the students’ responses regarding the importance of the instructional design practices in online courses were analyzed and reported using mode of the responses, the students’ responses regarding the inclusion of the instructional design practices in their online courses were analyzed and reported by percentage. In this question, the instructional design items were divided into three categories according to the importance of the items from students’ perspectives.
CHAPTER 4: FINDINGS

Objective 1: Demographic Characteristics

Gender

Table 3 shows the distribution of respondents (n=62) by gender. There were 37 (59.7%) males and 25 (40.3%) females.

Table 3

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>37</td>
<td>59.7</td>
</tr>
<tr>
<td>Female</td>
<td>25</td>
<td>40.3</td>
</tr>
</tbody>
</table>

Educational Level

Table 4 shows the educational level of the participants (n=62). Bachelor’s degree was the highest educational level for 52 online students (83.9%). There were seven respondents who indicated a Master’s degree as their highest educational level (11.3%). In addition, one student had received a Ph.D. (1.6%), one student had received an associate degree (1.6%) and one student had received a professional degree (1.6%).

Employment Status

Table 5 shows the distribution of respondents (n=61) by employment status. There were 51 (82.3%) full-time employees, four participants were part-time employees (6.5%), six participants were unemployed (9.7%) and one (1.6%) was self-employed.
### Table 4

**Distribution of online students by highest level of education earned (n=62)**

<table>
<thead>
<tr>
<th>Educational Level</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor’s degree</td>
<td>52</td>
<td>83.9</td>
</tr>
<tr>
<td>Master’s degree</td>
<td>7</td>
<td>11.3</td>
</tr>
<tr>
<td>Associate degree</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>Professional degree</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>Doctorate degree</td>
<td>1</td>
<td>1.6</td>
</tr>
</tbody>
</table>

### Table 5

**Distribution of online students by employment status (n=62)**

<table>
<thead>
<tr>
<th>Employment status</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time</td>
<td>51</td>
<td>82.3</td>
</tr>
<tr>
<td>Unemployed</td>
<td>6</td>
<td>9.7</td>
</tr>
<tr>
<td>Part-time</td>
<td>4</td>
<td>6.5</td>
</tr>
<tr>
<td>Self-employed</td>
<td>1</td>
<td>1.6</td>
</tr>
</tbody>
</table>

### Students Status

Table 6 shows the distribution of respondents (n=62) by student status. While there were 44 (71%), full-time students, there were 18 part-time students (29%).

### Table 6

**Distribution of online students by student status (n=62)**

<table>
<thead>
<tr>
<th>Student status</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part-time</td>
<td>44</td>
<td>71</td>
</tr>
<tr>
<td>Full-time</td>
<td>18</td>
<td>29</td>
</tr>
</tbody>
</table>

### Current Major

Table 7 shows the distribution of respondents (n=62) by the current area of study. Of the participants, 35.6% indicated a M.S. in Agronomy as their current major. M.S in Agricultural Education came in second with 19 participants (30.6%). Of the participants,
11 (17.7%) indicated a M.S. in Seed Technology and Business as their current major and six participants (9.7%) stated a M.S. in Plant Breeding as their current area of study. The last two majors were Graduate Certificate in Food Safety & Defense with three students (4.8%) and a M.S. in Agricultural Business and International Agriculture with one student (1.6%).

Table 7

The distribution of respondents by current major (n=62)

<table>
<thead>
<tr>
<th>Major</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.S. in Agronomy</td>
<td>22</td>
<td>35.5</td>
</tr>
<tr>
<td>M.S. in Agricultural Education</td>
<td>19</td>
<td>30.6</td>
</tr>
<tr>
<td>M.S. in Seed Technology and Business</td>
<td>11</td>
<td>17.7</td>
</tr>
<tr>
<td>M.S. in Plant Breeding</td>
<td>6</td>
<td>9.7</td>
</tr>
<tr>
<td>Graduate Certificate in Food Safety &amp; Defense</td>
<td>3</td>
<td>4.8</td>
</tr>
<tr>
<td>M.S. Agricultural Business and International Agriculture</td>
<td>1</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Number of Online Courses

Table 8 provides the frequencies and percentages of the number of online courses the students have taken. The number of online courses taken by participants in this study (n=62) ranged from 1-20. The mean of online courses students had taken was 5.69 (SD=3.84). The highest number of respondents (n=36, 58.1%) have taken between 1-5 online courses. There were 21 respondents (33.9%) who indicated they have taken 6-10 and four respondents (6.4%) stated they have taken 11-15 online courses. Only one student indicated they had taken more than 15 online courses.
Table 8

Number of online courses that have been taken by the participants (n=62)

<table>
<thead>
<tr>
<th>Number of online courses</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 5</td>
<td>36</td>
<td>58.1</td>
</tr>
<tr>
<td>6 - 10</td>
<td>21</td>
<td>33.9</td>
</tr>
<tr>
<td>11 - 15</td>
<td>4</td>
<td>6.4</td>
</tr>
<tr>
<td>16 - 20</td>
<td>1</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Note. M=5.69; SD=3.84

Objective 2: Perceived Distance

Participants were asked to indicate their perceived distance that they felt toward the instructor, the other online learners, the course content, the course website, and the course overall. A four-point Likert-type scale was used (4=very distant, 3= distant, 2= close, 1= very close) to describe learners’ perceived distance. Table 9 provides frequencies, percentages, means, and standard deviations for each item. The perceived distance from the other online learners was the highest (M=2.72; SD=0.61) compared to the perceived distance from the instructor, course content and course website. Most of the participants (67.1%) indicated that they felt the other learners were distant or very distant to them (60% distant and 7.1% very distant). Only, 32.8% of the participants stated that the other learners are close (31.4%) or very close (1.4%). The perceived distance from the online instructor came second (M=2.49; SD=0.65). Although 51.4% of the participants stated the instructor is close to them, 45.7% indicated they felt the instructor was distant, (40%) or very distant (5.7%).
Table 9.  
*The frequency and the percentage of the participants’ perceived distance from the instructor, the other learners, course content, and course website (n=70)*

<table>
<thead>
<tr>
<th>Item</th>
<th>Very Distant</th>
<th>Distant</th>
<th>Close</th>
<th>Very Close</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Online Learners.</td>
<td>5</td>
<td>71.4%</td>
<td>42</td>
<td>60.0%</td>
<td>22</td>
<td>31.4%</td>
</tr>
<tr>
<td>The instructor.</td>
<td>4</td>
<td>57.1%</td>
<td>28</td>
<td>40.0%</td>
<td>36</td>
<td>51.4%</td>
</tr>
<tr>
<td>Overall perceived distance.</td>
<td>2</td>
<td>29.0%</td>
<td>18</td>
<td>25.7%</td>
<td>49</td>
<td>70.0%</td>
</tr>
<tr>
<td>Course Content.</td>
<td>0</td>
<td>0.0%</td>
<td>10</td>
<td>14.3%</td>
<td>42</td>
<td>60.0%</td>
</tr>
<tr>
<td>Course Website.</td>
<td>1</td>
<td>14.3%</td>
<td>7</td>
<td>10.0%</td>
<td>39</td>
<td>55.7%</td>
</tr>
</tbody>
</table>

Note. 1= very close, 2= close, 3= distant, 4= very distant.

Table 9 shows the online students in this study felt the course content was closer to them than the instructor and the other students (M=1.89, SD=0.63). Of the participants, 85.7% indicated that the course content is close (60%) or very close (25.7%). The participants indicated that their perceived distance from the course website is the lowest (M=1.80, SD=0.67) on a four-point scale comparing to the perceived distance from the other students, the instructor, and the course content. The majority of the participants (88.6%) indicated they felt the course website was close or very close to them (55.7% close and 32.9% very close). Regarding overall perceived distance; most of the online students in this study (71.4%) rated their overall distance to their online courses as close (70%) or very close (1.4%). Whereas, 28.6% rated their overall distance to their online courses as distant (25.7%) or very distant (2.9%).
Objective 3: The Relationship Between the Perceived Transactional Distance and Learners’ Demographic Characteristics

Correlational statistics (The Spearman rho and Cramer’s V) were used to measure the associations between the CALS online students' selected demographic characteristics (gender, educational level, academic major, employment status, student status, and number of online courses have been taken) and their perceived distance from the online instructor, other online learners, course content, course website, and the course overall. Cramer’s V was used to measure the relationships between gender, educational level, academic major, employment status, student status, and the perceived distance. Spearman rho was used to calculate relationships between the number of online courses taken and the perceived distance from the online instructor, other online learners, course content, course website, and the course overall.

Table 10 presents the Spearman correlations between online students’ perceived distance and the number of online courses taken. The only significant relationship was between the number of online courses taken and the perceived distance from the instructor. The Spearman rho revealed a negative relationship between the number of online courses taken and the perceived distance from the instructor (r = -0.33; p < 0.01). That means the more online courses students take, the less distance they perceive toward the online instructors. According to Cohen’s (1988) guidelines, the effect size (ES) is medium. Table 10 also shows the Cramer’s V coefficients for the relationship between online students’ perceived distance and their demographic characteristics. The results show that the academic major had strong associations with the perceived distance from the instructor (Cramer’s V = 0.488; p < 0.01), the perceived distance from the course
content (Cramer’s V = 0.464; p < 0.01), and with the perceived distance from the overall course (Cramer’s V = 0.642; p < 0.01).

Table 10

*Correlation between online students’ perceived distance and their demographic characteristics*

<table>
<thead>
<tr>
<th>Perceived distance from</th>
<th>Gender¹</th>
<th>Educational level²</th>
<th>Major¹</th>
<th>Employment status¹</th>
<th>Student status¹</th>
<th>Number of online courses³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor</td>
<td>0.298</td>
<td>0.044</td>
<td>0.488**</td>
<td>0.199</td>
<td>0.232</td>
<td>-0.33**</td>
</tr>
<tr>
<td>Other online learners</td>
<td>0.175</td>
<td>-0.026</td>
<td>0.243</td>
<td>0.285</td>
<td>0.107</td>
<td>-0.06</td>
</tr>
<tr>
<td>Course content</td>
<td>0.109</td>
<td>0.042</td>
<td>0.464**</td>
<td>0.134</td>
<td>0.109</td>
<td>-0.02</td>
</tr>
<tr>
<td>Course website</td>
<td>0.167</td>
<td>0.045</td>
<td>0.302</td>
<td>0.130</td>
<td>0.244</td>
<td>0.05</td>
</tr>
<tr>
<td>The course overall</td>
<td>0.278</td>
<td>0.132</td>
<td>0.642**</td>
<td>0.265</td>
<td>0.353</td>
<td>-0.06</td>
</tr>
</tbody>
</table>

Note. ¹Cramer’s V. ²Spearman rho. **p < 0.01.

However, the results in Table 10 do not show any significant association between the perceived distance from the other online learners and the perceived distance from the course website with any of student’s demographic characteristics. Also, there were no significant associations between gender, educational level, employment status, and student status with perceived distance.

Table 11 shows how students from different majors perceived distance from their instructors. Participants from Seed Technology and Business, Plant Breeding, and Agricultural Business programs indicated that they perceived less distance from their instructors compared to participants from Food Safety, Agricultural Education, and Agronomy programs. Two out of three students (66.7%) from the Graduate Certificate in Food Safety program indicated that they felt their instructors were distant or very distant. The other student (33.3%) in this program indicated that they felt the instructor was close.
Of the students in Agricultural Education, 57.9% indicated that they felt their instructors were distant or very distant and 42.1% of the students in Agricultural Education felt their instructors were close. Half of the students in Agronomy felt that their instructors were distant (45.5%) or very distant (4.5%). The other half of the students in Agronomy indicated that their instructors were close. Students in Seed Technology and Business indicated that they felt their instructors were distant (36.4%) or very distant (9.1%). However, the majority of the students in this major (54.5%) felt that their instructors were close. All six participants from Plant Breeding program indicated that they felt their instructors were close (83.3%) or very close (16.7%). The only participant from the Agricultural Business program indicated that they felt the instructor was very close.

Table 11

<table>
<thead>
<tr>
<th>Major (number of students)</th>
<th>Perceived Distance from Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very Distant</td>
</tr>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>M.S. in Agronomy (22).</td>
<td>1</td>
</tr>
<tr>
<td>M.S. in Agricultural Education (19).</td>
<td>1</td>
</tr>
<tr>
<td>M.S. in Seed Technology and Business (11).</td>
<td>1</td>
</tr>
<tr>
<td>M.S. Plant Breeding (6).</td>
<td>0</td>
</tr>
<tr>
<td>Graduate Certificate in Food Safety (3).</td>
<td>1</td>
</tr>
<tr>
<td>M.S. Ag Business and International Ag (1).</td>
<td>0</td>
</tr>
</tbody>
</table>

Cramer’s V = 0.49** (p < 0.05)

Table 12 shows how students from different majors perceived distance course content. Participants from Seed Technology and Business, Plant Breeding, and Agricultural Business programs indicated that they perceived less distance from course content compared to participants from Food Safety, Agricultural Education, and Agronomy programs. One of the three students (33.3%) from the Graduate Certificate in Food Safety program indicated they felt course content was distant. The other two
students (66.7%) in this program indicated they felt the course content was very close. Of
the students in Agricultural Education, 31.6% indicated they felt course content was
distant and 68.4% of the students in Agricultural Education felt content was close
(63.1%) or very close (5.3%). 13.6% of the students in Agronomy felt that course content
was distant and 86.4% of the students in Agronomy indicated that content was close
(68.2%) or very close (18.2%). Students in Seed Technology and Business indicated that
they felt course content was close (72.7%) or very close (27.3%). All six participants
from Plant Breeding program indicated that they felt the course content was close
(16.7%) or very close (83.3%). The only participant from the Agricultural Business
program indicated that they felt course content was very close.

Table 12
Perceived distance from course content by major

<table>
<thead>
<tr>
<th>Major (number of students)</th>
<th>Perceived Distance from Course Content</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very Distant</td>
</tr>
<tr>
<td>M.S. in Agronomy (22).</td>
<td>0</td>
</tr>
<tr>
<td>M.S. in Agricultural Education (19).</td>
<td>0</td>
</tr>
<tr>
<td>M.S. in Seed Technology and Business (11).</td>
<td>0</td>
</tr>
<tr>
<td>M.S. Plant Breeding (6).</td>
<td>0</td>
</tr>
<tr>
<td>Graduate Certificate in Food Safety (3).</td>
<td>0</td>
</tr>
<tr>
<td>M.S. Ag Business and International Ag (1).</td>
<td>0</td>
</tr>
</tbody>
</table>

Cramer’s V = 0.46** (p< 0.05)

Table 13 shows how students from different majors perceived distance from the
course overall. Participants from Seed Technology and Business, Plant Breeding, and
Agricultural Business programs indicated they perceived less distance from the course
overall compared to participants from Agricultural Education, Food Safety, and
Agronomy programs. Of the students in Agricultural Education, 57.9% indicated they felt
the course overall was distant (47.4%) or very distant (10.5%) and 42.1% of the students
in Agricultural Education felt that course overall was close. One of the three students (33.3%) from Graduate Certificate in Food Safety program indicated they felt course overall was distant. The other two students (66.7%) in this program indicated they felt the course overall was close. 22.7% of the students in Agronomy felt course overall was distant and 77.3% of the students in Agronomy indicated the course overall was close. Only 9.9% of the students in Seed Technology and Business indicated they felt course overall was distant. However, the majority of the students in this major (90.1%) felt their course overall was close. All six participants from the Plant Breeding program indicated they felt the course overall was close. The only participant from the Agricultural Business program indicated that she/he felt the overall course was very close.

Table 13

<table>
<thead>
<tr>
<th>Major (number of students)</th>
<th>Perceived Distance from Course Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very Distant</td>
</tr>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>M.S. in Agronomy (22).</td>
<td>0</td>
</tr>
<tr>
<td>M.S. in Agricultural Education (19).</td>
<td>2</td>
</tr>
<tr>
<td>M.S. in Seed Technology and Business (11).</td>
<td>0</td>
</tr>
<tr>
<td>M.S. Plant Breeding (6).</td>
<td>0</td>
</tr>
<tr>
<td>Graduate Certificate in Food Safety (3).</td>
<td>0</td>
</tr>
<tr>
<td>M.S. Ag Business and International Ag (1).</td>
<td>0</td>
</tr>
</tbody>
</table>

Cramer’s V = 0.64** (p< 0.05)

Objective 4. Online Learners’ Perceptions Regarding the Factors of Transactional Distance (Course Structure, Dialogue, and Learner’s Autonomy)

Course Structure

The participants were asked to indicate their level of agreement with ten statements related course structure based on their experience in the online course they
were taking during the fall semester of 2017. This objective used a 5-point scale (1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree) to describe the agreement with the structure statements. Table 14 provides frequency, percentage, mean, and standard deviation for each item related to the course structure. The three structure statements that the online students agreed with most were “my online course provides a flexible learning experience” (agree 28.6%; strongly agree 55.7%), “the course calendar provides due dates for course activities” (agree 30%; strongly agree 54.3%), and “The course has clear objectives” (agree 48.6%; strongly agree 41.4%). Means and standard deviations for these three statements were 4.27(1.1), 4.24(1.1), and 4.20(0.99) respectively.

These three statements were followed by “The syllabus clearly states what I need to do” (M=4.07; SD=0.997) and “The course provides activities that help me learn” (M=4.07; SD=1.08). Regarding these two statements, online students have an agreement (51.4% agree; 34.3% strongly agree) about the clarity of the syllabus of their online courses. Likewise, they have an agreement (44.3% agree; 38.6% strongly agree) that their online courses provide activities that help them to learn. The three structure statements that the online students agreed with least were “My online course provides an engaging learning environment” (agree 58.6%; strongly agree 8.6%), “The number of activities is appropriate” (agree 50%; strongly agree 28.7%), and “The subject matter is appropriate for online delivery” (agree 48.6%; strongly agree 30%). Mean and standard deviation for these three statements were 3.62(0.89), 3.86(1.1), and 3.97(0.98) respectively. In general, the students’ perceptions regarding the course structure items were positive; the mean
range between 4.27 for the highest and 3.62 for the lowest. This indicates that the participants consider their online courses as highly structured courses.

Table 14

*The frequency and the percentage of the participants’ perceptions regarding their online course structure (n=70)*

<table>
<thead>
<tr>
<th>Course Structure Statements</th>
<th>SD</th>
<th>N</th>
<th>A</th>
<th>SA</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>My online course provides a flexible learning experience.</td>
<td>4</td>
<td>6</td>
<td>20</td>
<td>39</td>
<td>55.7</td>
<td>4.27</td>
</tr>
<tr>
<td>The course calendar provides due dates for course activities (readings, discussions, assignments ...etc.)</td>
<td>3</td>
<td>4</td>
<td>21</td>
<td>38</td>
<td>54.3</td>
<td>4.24</td>
</tr>
<tr>
<td>The course has clear objectives.</td>
<td>4</td>
<td>1</td>
<td>1.4</td>
<td>34</td>
<td>48.6</td>
<td>29</td>
</tr>
<tr>
<td>The syllabus clearly states what I need to do throughout the semester.</td>
<td>4</td>
<td>1</td>
<td>1.4</td>
<td>36</td>
<td>51.4</td>
<td>24</td>
</tr>
<tr>
<td>The course provides activities (readings, discussions, assignments, etc.) that help me learn.</td>
<td>4</td>
<td>3</td>
<td>4.3</td>
<td>31</td>
<td>44.3</td>
<td>27</td>
</tr>
<tr>
<td>The activities (readings, discussions, assignments, etc.) are relevant.</td>
<td>3</td>
<td>5</td>
<td>7.1</td>
<td>32</td>
<td>45.7</td>
<td>26</td>
</tr>
<tr>
<td>The grading system is clear.</td>
<td>3</td>
<td>4</td>
<td>3.3</td>
<td>33</td>
<td>47.1</td>
<td>24</td>
</tr>
<tr>
<td>The subject matter is appropriate for online delivery.</td>
<td>3</td>
<td>2</td>
<td>2.9</td>
<td>10</td>
<td>14.3</td>
<td>34</td>
</tr>
<tr>
<td>The number of activities (readings, discussions, assignments ...etc.) is appropriate.</td>
<td>5</td>
<td>5</td>
<td>7.1</td>
<td>35</td>
<td>50.0</td>
<td>20</td>
</tr>
<tr>
<td>My online course provides an engaging learning environment.</td>
<td>3</td>
<td>4</td>
<td>5.7</td>
<td>15</td>
<td>21.4</td>
<td>41</td>
</tr>
</tbody>
</table>

*Note. SD=strongly disagree(1), D=disagree(2), N=natural(3), A=agree(4), SA=strongly agree(5).*
Interactions

The participants were asked to indicate the frequency of interaction items based on their experience in the online course they were taking during the fall semester of 2017. Learners used a 5-point scale (1= never, 2= rarely, 3= sometimes, 4= often, 5= always) to describe the frequency of 27 interaction items related to four types of interactions within online learning environments.

Student-Instructor Interaction

Table 1 provides frequency, percentage, mean, and standard deviation for each item related to student-instructor interaction. The three interaction statements the online students more frequently used were “the instructor is available by email” (often 22.9%; always 67.1%), “the instructor encourages me to participate in coursework” (often 32.9%; always 51.4%), and “the instructor provides sufficient information when I ask questions.” (often 35.7%; always 48.6%). Means and standard deviations for these three statements were 4.50(0.88), 4.34(0.78), and 4.29(0.88) respectively.

These three statements were followed by “the instructor provides appropriate academic assistance” (M=4.27; SD=0.90) and “the instructor provides ample time for interaction” (M=4.19; SD=0.87). Regarding these two statements, online students indicated (often 40%; always 47.1%) that their instructors provide appropriate academic assistance. Likewise, online students indicated (often 44.3%; always 40%) they have ample time for interacting with their instructors.

However, the last three statements in student-instructor interaction that are shown in Table 15 were “the instructor interaction enhances my learning” (often 51.4%; always 20%), “the instructor provides opportunities to discuss topics related to the subject
matter” (often 45.7%; always 34.3%), and “the instructor provides timely feedback on coursework” (often 38.6%; always 40%). Mean and standard deviation for these three statements were 3.80(0.93), 4.10(0.82), and 4.11(0.93) respectively. In general, the students’ perceptions regarding the student-instructor interaction items were positive; the mean ranged between 4.50 for the highest and 3.80 for the lowest. That indicates that the participants consider the student-instructor interaction in their online courses was high.

Table 1

*The frequency and the percentage of the participants’ perceptions regarding the student-instructor interaction in their online course (n=70)*

<table>
<thead>
<tr>
<th>Student-Instructor Interaction</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>The instructor is available by email.</td>
<td>1</td>
<td>1.4</td>
<td>3</td>
<td>4.3</td>
<td>16</td>
<td>22.9</td>
<td>47</td>
</tr>
<tr>
<td>The instructor encourages me to participate in coursework.</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1.4</td>
<td>10</td>
<td>14.3</td>
<td>23</td>
</tr>
<tr>
<td>The instructor provides sufficient information when I ask questions.</td>
<td>1</td>
<td>1.4</td>
<td>2</td>
<td>2.9</td>
<td>7</td>
<td>10.0</td>
<td>25</td>
</tr>
<tr>
<td>The instructor provides appropriate academic assistance.</td>
<td>2</td>
<td>2.9</td>
<td>1</td>
<td>1.4</td>
<td>6</td>
<td>8.6</td>
<td>28</td>
</tr>
<tr>
<td>The instructor provides ample time for interaction.</td>
<td>2</td>
<td>2.9</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>12.9</td>
<td>31</td>
</tr>
<tr>
<td>The instructor provides timely feedback on coursework.</td>
<td>1</td>
<td>1.4</td>
<td>3</td>
<td>4.3</td>
<td>11</td>
<td>15.7</td>
<td>27</td>
</tr>
<tr>
<td>The instructor provides opportunities to discuss topics related to the subject matter.</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>4.3</td>
<td>11</td>
<td>15.7</td>
<td>32</td>
</tr>
<tr>
<td>The instructor interaction enhances my learning.</td>
<td>2</td>
<td>2.9</td>
<td>4</td>
<td>5.7</td>
<td>14</td>
<td>20.0</td>
<td>36</td>
</tr>
</tbody>
</table>

Note. 1= Never, 2= Rarely, 3= Sometimes, 4= Often, 5= Always.

**Student-Student Interaction.**

Table 16 provides frequency, percentages, mean, and standard deviation for each item related to student-student interaction. The two interaction statements that the online
students more frequently use were “I participate in discussions with other students” (often 27.1%; always 37.1%), and “the course is an online learning community” (often 47.1%; always 21.4%). Mean and standard deviation for these two statements were 3.83(1.9), and 3.76(0.98) respectively. Although the online students indicated that they most frequently participate in discussions and most of the time consider their online courses are learning communities, there were 41.4% of the students who indicated that interacting with other students only “sometimes” enhances their learning (M=3.29; SD=1.1).

Table 16

The frequencies and the percentages of the participant's perceptions regarding the

Student-Student interaction in their online course (n=70)

<table>
<thead>
<tr>
<th>Student-Student Interaction</th>
<th>Never n</th>
<th>%</th>
<th>Rarely n</th>
<th>%</th>
<th>Sometimes n</th>
<th>%</th>
<th>Often n</th>
<th>%</th>
<th>Always n</th>
<th>%</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>I participate in discussions with other students.</td>
<td>5</td>
<td>7.1</td>
<td>3</td>
<td>4.3</td>
<td>17</td>
<td>24.3</td>
<td>19</td>
<td>27.1</td>
<td>26</td>
<td>37.1</td>
<td>3.83</td>
<td>1.19</td>
</tr>
<tr>
<td>The course is an online learning community.</td>
<td>2</td>
<td>2.9</td>
<td>6</td>
<td>8.6</td>
<td>14</td>
<td>20.0</td>
<td>33</td>
<td>47.1</td>
<td>15</td>
<td>21.4</td>
<td>3.76</td>
<td>0.98</td>
</tr>
<tr>
<td>Interacting with other students enhances my learning.</td>
<td>7</td>
<td>10.0</td>
<td>5</td>
<td>7.1</td>
<td>29</td>
<td>41.4</td>
<td>19</td>
<td>27.1</td>
<td>10</td>
<td>14.3</td>
<td>3.29</td>
<td>1.12</td>
</tr>
<tr>
<td>I share course responsibilities with other learners.</td>
<td>15</td>
<td>21.4</td>
<td>15</td>
<td>21.4</td>
<td>22</td>
<td>31.4</td>
<td>13</td>
<td>18.6</td>
<td>5</td>
<td>7.1</td>
<td>2.69</td>
<td>1.21</td>
</tr>
<tr>
<td>I contact other students in the course via e-mail.</td>
<td>24</td>
<td>34.3</td>
<td>19</td>
<td>27.1</td>
<td>18</td>
<td>25.7</td>
<td>4</td>
<td>5.7</td>
<td>5</td>
<td>7.1</td>
<td>2.24</td>
<td>1.20</td>
</tr>
</tbody>
</table>

Note. 1= Never, 2= Rarely, 3= Sometimes, 4= Often, 5= Always.

However, the results showed that the online students in this study were less likely (21.4% never; 21.4% rarely) to share course responsibilities with other learners (M=2.69; SD=1.2). Moreover, the online students in this study were much less likely (34.3% never; 27.1% rarely) to contact other students in the course via e-mail (M=2.24; SD=1.2). In
general, the online students’ perceptions regarding the student-student interaction was lower than the three other types (the mean ranged between 3.83(1.2) to 2.24(1.2)).

**Student-Content Interaction.**

Table 17 provides frequencies, percentages, means, and standard deviations for each item related to student-content interaction. The two student-content interaction statements that the online students more frequently used were “the course content is related to the learning objectives” (often 50%; always 42.9%), and “the course content includes accessible readings” (often 40%; always 47.1%). Means and standard deviations for these two statements were 4.34(0.66), and 4.31(0.79) respectively.

These two statements were followed by “the course content is at a level appropriate for me” (M=4.27; SD=0.76) and “the course content provides information related to the real-life situations” (M=4.19; SD=0.73). Regarding these two statements, online students indicated (often 51.4%; always 40%) that the content level in their online courses is appropriate for them. Likewise, online students indicated (often 52.9%; always 34.3%) the content in their courses is related to the real-life situations.

However, Table 17 also shows, the two statements that were least often true in student-content interaction were “The course content is ordered in such a way that makes learning easier” (often 48.6%; always 34.3%) and “the course content is interesting” (often 55.7%; always 24.3%). Mean and standard deviation for these two statements were 3.97(0.85) and 4.11(0.86) respectively. In general, the students’ perceptions regarding the student-content interaction items were positive; the mean ranged between 4.34 and 3.97. Participants consider the student-content interaction in their online courses is high.
Table 17

The frequencies and the percentages of the participant's perceptions regarding student-content interaction in their online course (n=70)

<table>
<thead>
<tr>
<th>Student-Content Interaction</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>The course content is related to the learning objectives.</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>5.70</td>
<td>35</td>
<td>50.0</td>
</tr>
<tr>
<td>The course content includes accessible readings.</td>
<td>1</td>
<td>1.4</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>11.4</td>
<td>28</td>
</tr>
<tr>
<td>The course content is at a level appropriate for me.</td>
<td>1</td>
<td>1.4</td>
<td>1</td>
<td>4</td>
<td>5.70</td>
<td>36</td>
<td>51.4</td>
</tr>
<tr>
<td>The course content provides information related to the real-life situations.</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>7</td>
<td>10.0</td>
<td>37</td>
<td>52.9</td>
</tr>
<tr>
<td>The course content is interesting.</td>
<td>2</td>
<td>2.9</td>
<td>0</td>
<td>10</td>
<td>14.3</td>
<td>34</td>
<td>48.6</td>
</tr>
<tr>
<td>The course content is ordered in such a way that makes learning easier.</td>
<td>2</td>
<td>2.9</td>
<td>1</td>
<td>11</td>
<td>15.7</td>
<td>39</td>
<td>55.7</td>
</tr>
</tbody>
</table>

Note. 1= Never, 2= Rarely, 3= Sometimes, 4= Often, 5= Always.

Student-Website Interaction.

Table 18 provides frequencies, percentages, mean, and standard deviation for each item related to student-website interaction. The three interaction statements that the online students indicated more frequently occurred were “the course website uses appropriate font sizes and colors” (often 52.9%; always 41.4%), “the course website is consistent throughout its pages” (often 48.6%; always 38.6%), and “the course website is well organized” (often 47.1%; always 40%). Mean and standard deviation for these three statements were 4.33(0.70), 4.24(0.71), and 4.24(0.77) respectively. These three statements were followed by “the course website is easy to navigate” (M=4.24; SD=0.81) and “I could access the learning platform from different devices” (M=4.22; SD=0.87).

Regarding these two statements, online students indicated (often 45.7%; always 41.4%) that the course website is convenient and easy to use. Likewise, online students indicated
(often 40%; always 42.9%) they could access the LMS using a PC, a laptop, a tablet, and/or a smartphone. However, the least frequently occurring statements in student-website interaction were “technical support can be found in different channels” (often 42.9%; always 30%), “technical support is provided as needed” (often 42.9%; always 35.7%), and “the course platform is appropriate for the subject matter” (often 52.9%; always 34.3%). Means and standard deviations for these three statements were 3.99(0.87), 4.13(0.82), and 4.19(0.73), respectively. In general, the students’ perceptions regarding the student-website interaction items were positive; the mean ranged between 4.33 for the highest and 3.99 for the lowest. That indicates that the participants consider the student-website interaction in their online courses is very high.

Table 18
The frequencies and the percentages of the participants’ perceptions regarding the student-website interaction in their online course (n=70)

<table>
<thead>
<tr>
<th>Student-Website Interaction</th>
<th>Never n</th>
<th>%</th>
<th>Rarely n</th>
<th>%</th>
<th>Sometimes n</th>
<th>%</th>
<th>Often n</th>
<th>%</th>
<th>Always n</th>
<th>%</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>The course website uses appropriate font sizes and colors.</td>
<td>1</td>
<td>1.4</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>4.3</td>
<td>37</td>
<td>52.9</td>
<td>29</td>
<td>41.4</td>
<td>4.33</td>
<td>0.70</td>
</tr>
<tr>
<td>The course website is consistent throughout its pages.</td>
<td>0</td>
<td>0.0</td>
<td>1</td>
<td>1.4</td>
<td>8</td>
<td>11.4</td>
<td>34</td>
<td>48.6</td>
<td>27</td>
<td>38.6</td>
<td>4.24</td>
<td>0.71</td>
</tr>
<tr>
<td>The course website is well organized.</td>
<td>1</td>
<td>1.4</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>11.4</td>
<td>33</td>
<td>47.1</td>
<td>28</td>
<td>40.0</td>
<td>4.24</td>
<td>0.77</td>
</tr>
<tr>
<td>The course website is easy to navigate.</td>
<td>1</td>
<td>1.4</td>
<td>1</td>
<td>1.4</td>
<td>7</td>
<td>10.0</td>
<td>32</td>
<td>45.7</td>
<td>29</td>
<td>41.4</td>
<td>4.24</td>
<td>0.81</td>
</tr>
<tr>
<td>I could access the learning platform from different devices (i.e. PC, laptop, tablet, and/or smartphone).</td>
<td>1</td>
<td>1.4</td>
<td>2</td>
<td>2.9</td>
<td>8</td>
<td>11.4</td>
<td>28</td>
<td>40.0</td>
<td>30</td>
<td>42.9</td>
<td>4.22</td>
<td>0.87</td>
</tr>
<tr>
<td>The course platform (Blackboard) is appropriate for the subject matter.</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2.9</td>
<td>7</td>
<td>10.0</td>
<td>37</td>
<td>52.9</td>
<td>24</td>
<td>34.3</td>
<td>4.19</td>
<td>0.73</td>
</tr>
<tr>
<td>Technical support is provided as needed.</td>
<td>1</td>
<td>1.4</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>18.6</td>
<td>30</td>
<td>42.9</td>
<td>25</td>
<td>35.7</td>
<td>4.13</td>
<td>0.82</td>
</tr>
<tr>
<td>Technical support can be found in different channels (Web pages, telephone, e-mail request).</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>5.7</td>
<td>14</td>
<td>20.0</td>
<td>30</td>
<td>42.9</td>
<td>21</td>
<td>30.0</td>
<td>3.99</td>
<td>0.87</td>
</tr>
</tbody>
</table>

Note. 1= Never, 2= Rarely, 3= Sometimes, 4= Often, 5= Always.
Learner Autonomy

Online learners were asked to indicate their level of agreement with statements that describe them as online learners. This construct used a 5-point scale (1= strongly disagree, 2= disagree, 3= natural, 4= agree, 5= strongly agree) to describe learners’ agreement. Table 19 shows that the majority of the participants (94.3%) stated that they are able to find resources for study (M=4.36; SD=0.64). Also, most of the participants (91.4%) indicated their ability to develop a personal learning plan for themselves (M=4.33; SD=0.63). Moreover, 90% described themselves as self-directed learners (M=4.29; SD=0.68). Of the participants, 81.4% described themselves as independent learners (M=4.10; SD=0.89), and 80% of the students agreed or strongly agreed on their ability to learn without lots of guidance (M=4.01; SD=0.77).

Table 19
The frequencies and the percentages of the participants’ perceptions regarding their perceived learning autonomy (n=70)

<table>
<thead>
<tr>
<th>Learner Autonomy</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am able to find resources for study.</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4.3</td>
<td>36</td>
<td>51.4</td>
<td>30</td>
</tr>
<tr>
<td>I am able to develop a personal learning plan.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8.6</td>
<td>35</td>
<td>50.0</td>
<td>29</td>
</tr>
<tr>
<td>I am a self-directed learner.</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>8.6</td>
<td>35</td>
<td>50.0</td>
<td>28</td>
</tr>
<tr>
<td>I regard myself as an independent learner.</td>
<td>1</td>
<td>1.4</td>
<td>3</td>
<td>12.9</td>
<td>32</td>
<td>45.7</td>
<td>25</td>
</tr>
<tr>
<td>I am able to learn without lots of guidance.</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>11.4</td>
<td>38</td>
<td>54.3</td>
<td>18</td>
</tr>
<tr>
<td>I like to help other students.</td>
<td>3</td>
<td>4.3</td>
<td>7</td>
<td>30.0</td>
<td>27</td>
<td>38.6</td>
<td>11</td>
</tr>
<tr>
<td>I need collaborative learning.</td>
<td>2</td>
<td>2.9</td>
<td>16</td>
<td>41.4</td>
<td>18</td>
<td>25.7</td>
<td>4</td>
</tr>
</tbody>
</table>

Note. SD=strongly disagree(1), D=disagree(2), N=natural(3), A=agree(4), SA=strongly agree(5). N=70.

On the other hand, only half of the participants (50%) agreed or strongly agreed that they liked to help other students in their online courses (M=3.52; SD=1.02). Much
less, only 31.4% of the students indicated their need for collaborative learning (M=3.09; SD=0.92). These results indicated that online students in this study possess a high level of autonomy.

**Objective 5. The Relationship Between the Perceived Transactional Distance and Learners’ Perceptions Regarding the Transactional Distance Factors (Course Structure, Dialogue, and Learner Autonomy)**

According to the nature of the variables and the positive skewness issue in the data, the nonparametric Spearman rho was used to measure the associations between the CALS online students' perceived distance from the instructor, the other online students, the course content, the course website, and the overall course and factors of transactional distance (course interactions, course structure, and learner autonomy).

**The Relationship Between Students’ Perceived Distance and Course Structure Items**

The relationship between the perceived distance from the instructor and course structure items.

Table 20 presents the Spearman correlations between the online students' perceived distance from the instructor and the course structure items ranked by the ES. The calculated Spearman rho indicated that the students’ perceived distance from the instructor is significantly correlated with all course structure items, except the course calendar. All the correlations were negative; which means developing an online course that has an engaging and a flexible environment, and relevant and an appropriate number of activities that really help students to learn, in addition to clear objectives, a clear grading system, and syllabus, would lead to less distance between online learners and their instructors. The effect size was medium for grading system (-0.45), engaging
learning environment (-0.42), helpful learning activities (-0.37), flexible learning (-0.34), appropriateness for online delivery (-0.34), relevant activities (-0.33), number of activities (-0.31), and clear objectives (-0.30). The course syllabus had a small effect size (-0.24) (Cohen, 1988).

Table 20
Correlation between online students’ perceived distance from the instructor and the course structure items

<table>
<thead>
<tr>
<th>Course structure items</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>The grading system is clear.</td>
<td>-0.45*</td>
</tr>
<tr>
<td>My online course provides an engaging learning environment.</td>
<td>-0.42**</td>
</tr>
<tr>
<td>The course provides activities that help me learn.</td>
<td>-0.37**</td>
</tr>
<tr>
<td>My online course provides a flexible learning experience.</td>
<td>-0.34**</td>
</tr>
<tr>
<td>The subject matter is appropriate for online delivery.</td>
<td>-0.34**</td>
</tr>
<tr>
<td>The activities are relevant.</td>
<td>-0.33**</td>
</tr>
<tr>
<td>The number of activities is appropriate.</td>
<td>-0.31**</td>
</tr>
<tr>
<td>The course has clear objectives.</td>
<td>-0.30*</td>
</tr>
<tr>
<td>The syllabus clearly states what I need to do throughout the semester.</td>
<td>-0.24*</td>
</tr>
<tr>
<td>The course calendar provides due dates for course activities</td>
<td>-0.14</td>
</tr>
</tbody>
</table>

* Course structure scale: 1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree.
* Perceived distance scale: 1 = very close, 2 = close, 3 = distant, 4 = very distant.
* p < 0.05. **p < 0.01.

The relationship between the perceived distance from the other online students and course structure items.

Table 21 presents the Spearman correlations between the online students' perceived distance from the other online students and the course structure items ranked by the effect size. The calculated Spearman rho indicated that the students’ perceived distance to the other online students is only significantly correlated with engaging learning environment (-0.36) and the appropriate number of activities in an online course (-0.25). The correlations were negative; which means the more an online course possessed an engaging environment and an appropriate number of activities, the less distance the students perceive from each other. According to Cohen (1988), both associations had a medium effect size.
Table 21
Correlation between online students’ perceived distance from the other online students and the course structure items

<table>
<thead>
<tr>
<th>Course structure items</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>My online course provides an engaging learning environment.</td>
<td>-0.36**</td>
</tr>
<tr>
<td>The number of activities is appropriate.</td>
<td>-0.25*</td>
</tr>
<tr>
<td>The activities are relevant.</td>
<td>-0.13</td>
</tr>
<tr>
<td>The subject matter is appropriate for online delivery.</td>
<td>-0.12</td>
</tr>
<tr>
<td>The course provides activities that help me learn.</td>
<td>-0.11</td>
</tr>
<tr>
<td>My online course provides a flexible learning experience.</td>
<td>-0.11</td>
</tr>
<tr>
<td>The course calendar provides due dates for course activities</td>
<td>-0.10</td>
</tr>
<tr>
<td>The syllabus clearly states what I need to do throughout the semester.</td>
<td>-0.08</td>
</tr>
<tr>
<td>The course has clear objectives.</td>
<td>-0.07</td>
</tr>
<tr>
<td>The grading system is clear.</td>
<td>-0.04</td>
</tr>
</tbody>
</table>

Course structure scale: 1= Strongly disagree, 2= Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree.
Perceived distance scale: 1=very close, 2=close, 3=distant, 4=very distant.
* p < 0.05. **p < 0.01.

The relationship between the perceived distance from the course content and course structure items.

Table 22 presents the Spearman correlations between the online students' perceived distance from the course content and the course structure items ranked by the effect size. The calculated Spearman rho indicated that the students’ perceived distance to course content is significantly correlated with half of the course structure items (five). The perceived distance to content was negatively associated with engaging learning environment (-0.50), the course syllabus (-0.36), relevant activities (-0.33), clear objectives (-0.32), and helpful learning activities (-0.24). While “engaging learning environment” had a large size effect, each one of the rest of the significantly correlated items had medium effect size (Cohen, 1988).
Table 22

*Correlation between online students’ perceived distance from the course content and the course structure items*

<table>
<thead>
<tr>
<th>Course structure items</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>My online course provides an engaging learning environment.</td>
<td>-0.50**</td>
</tr>
<tr>
<td>The syllabus clearly states what I need to do throughout the semester.</td>
<td>-0.36**</td>
</tr>
<tr>
<td>The activities are relevant.</td>
<td>-0.33**</td>
</tr>
<tr>
<td>The course has clear objectives.</td>
<td>-0.32**</td>
</tr>
<tr>
<td>The course provides activities that help me learn.</td>
<td>-0.24**</td>
</tr>
<tr>
<td>The grading system is clear.</td>
<td>-0.23</td>
</tr>
<tr>
<td>The course calendar provides due dates for course activities</td>
<td>-0.22</td>
</tr>
<tr>
<td>The subject matter is appropriate for online delivery.</td>
<td>-0.21</td>
</tr>
<tr>
<td>My online course provides a flexible learning experience.</td>
<td>-0.20</td>
</tr>
<tr>
<td>The number of activities is appropriate.</td>
<td>-0.14</td>
</tr>
</tbody>
</table>

Course structure scale: 1= Strongly disagree, 2= Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree.
Perceived distance scale: 1=very close, 2=close, 3=distant, 4=very distant.
* p < 0.05. **p < 0.01.

**The relationship between the perceived distance from the course website and course structure items.**

Table 23 presents the Spearman correlations between the online students' perceived distance from the course website and the course structure items ranked by the effect size. The calculated Spearman rho indicated that the students’ perceived distance to the website is significantly correlated with all course structure items, but not the course calendar. All the correlations were negative; which means developing an online course that has an engaging and flexible environment, and relevant and appropriate number of activities that really help students to learn, in addition to clear objectives, a clear grading system, and syllabus, would lead to less perceived distance between online learners and the course website.
Table 23

*Correlation between online students’ perceived distance from the course website and the course structure items*

<table>
<thead>
<tr>
<th>Course structure items</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>The course has clear objectives.</td>
<td>-0.53**</td>
</tr>
<tr>
<td>The syllabus clearly states what I need to do throughout the semester.</td>
<td>-0.46**</td>
</tr>
<tr>
<td>The activities are relevant.</td>
<td>-0.45**</td>
</tr>
<tr>
<td>My online course provides an engaging learning environment.</td>
<td>-0.44**</td>
</tr>
<tr>
<td>The course provides activities that help me learn.</td>
<td>-0.40**</td>
</tr>
<tr>
<td>The subject matter is appropriate for online delivery.</td>
<td>-0.37**</td>
</tr>
<tr>
<td>My online course provides a flexible learning experience.</td>
<td>-0.35**</td>
</tr>
<tr>
<td>The grading system is clear.</td>
<td>-0.32**</td>
</tr>
<tr>
<td>The number of activities is appropriate.</td>
<td>-0.29*</td>
</tr>
<tr>
<td>The course calendar provides due dates for course activities</td>
<td>-0.21</td>
</tr>
</tbody>
</table>

Course structure scale: 1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree.
Perceived distance scale: 1 = very close, 2 = close, 3 = distant, 4 = very distant.
* p < 0.05, ** p < 0.01.

The effect size for “clear objectives” was large (-0.53). Whereas, the effect size was medium for the course syllabus (-0.46), relevant activities (-0.45), engaging learning environment (-0.44), helpful learning activities (-0.40), appropriateness for online delivery (-0.37), flexible learning (-0.35), and grading system (-0.32). The number of activities had a small effect size (-0.29). (Cohen, 1988).

The relationship between the perceived distance from the course overall and course structure items.

Table 24 presents the Spearman correlations between the online students’ perceived distance from their online courses in general and the course structure items ranked by the effect size. The calculated Spearman rho indicated that the students’ perceived distance to the course overall is significantly correlated with all course structure items. All the correlations were negative; which means developing an online course that has an engaging and flexible environment, and relevant and appropriate number of activities that really help students to learn, in addition to clear objectives, a
clear grading system, syllabus, and comprehensive calendar, would lead to less distance
between learners and online courses. The effect size for “engaging learning environment”
was large (-0.58). Whereas, the effect size was medium for helpful learning activities (-0.39), relevant activities (-0.38), grading system (-0.35), the number of activities (-0.34),
appropriateness for online delivery (-0.34), and flexible learning (-0.33). The effect size
was small for course syllabus (-0.27), clear objectives” (-0.26) and course calendar (-0.26) (Cohen, 1988).

Table 24
*Correlation between online students’ perceived distance from the online course overall
and the course structure items*

<table>
<thead>
<tr>
<th>Course structure items</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>My online course provides an engaging learning environment.</td>
<td>-0.58**</td>
</tr>
<tr>
<td>The course provides activities that help me learn.</td>
<td>-0.39**</td>
</tr>
<tr>
<td>The activities are relevant.</td>
<td>-0.38**</td>
</tr>
<tr>
<td>The grading system is clear.</td>
<td>-0.35**</td>
</tr>
<tr>
<td>The number of activities is appropriate.</td>
<td>-0.34**</td>
</tr>
<tr>
<td>The subject matter is appropriate for online delivery.</td>
<td>-0.34**</td>
</tr>
<tr>
<td>My online course provides a flexible learning experience.</td>
<td>-0.33**</td>
</tr>
<tr>
<td>The syllabus clearly states what I need to do throughout the semester.</td>
<td>-0.27*</td>
</tr>
<tr>
<td>The course has clear objectives.</td>
<td>-0.26*</td>
</tr>
<tr>
<td>The course calendar provides due dates for course activities.</td>
<td>-0.26*</td>
</tr>
</tbody>
</table>

Course structure scale: 1= Strongly disagree, 2= Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree.
Perceived distance scale: 1=very close, 2=close, 3=distant, 4=very distant.
* p < 0.05. **p < 0.01.

The Relationship Between Students’ Perceived Distance and Course Interactions

The relationship between the perceived distance from the instructor and student-instructor interaction.

Table 25 presents the Spearman correlations between the online students' perceived distance from the instructor and the student-instructor interaction items ranked by the effect size. The calculated Spearman rho indicated that the students’ perceived distance to the instructor is significantly correlated with three out of the eight items listed under the student-instructor interaction. The perceived distance to the instructor
negatively correlated with the student-instructor interaction when the instructor enhances students learning (-0.40), provides appropriate assistance (-0.30) and encourages the students to participate in course activities (-0.28). Enhancing the learning process and appropriate academic assistance had a medium effect size, whereas, encouragement had a small effect size (Cohen, 1988).

Table 25

*Correlation between online students’ perceived distance from the instructor and the student-instructor interaction items*

<table>
<thead>
<tr>
<th>Student-Instructor Interaction Items</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instructor interaction enhances my learning.</td>
<td>-0.40**</td>
</tr>
<tr>
<td>The instructor provides appropriate academic assistance.</td>
<td>-0.30*</td>
</tr>
<tr>
<td>The instructor encourages me to participate in coursework.</td>
<td>-0.28*</td>
</tr>
<tr>
<td>The instructor provides ample time for interaction.</td>
<td>-0.23</td>
</tr>
<tr>
<td>The instructor is available by email.</td>
<td>-0.23</td>
</tr>
<tr>
<td>The instructor provides timely feedback on coursework.</td>
<td>-0.23</td>
</tr>
<tr>
<td>The instructor provides sufficient information when I ask questions.</td>
<td>-0.21</td>
</tr>
<tr>
<td>The instructor provides opportunities to discuss topics related to the subject matter.</td>
<td>-0.21</td>
</tr>
</tbody>
</table>

Interaction Scale: 1= Never, 2= Rarely, 3= Sometimes, 4= Often, 5= Always.
Perceived Distance Scale: 1=very close, 2=close, 3=distant, 4=very distant.
* p < 0.05. **p < 0.01.

The relationship between the perceived distance from the other online students and student-student interaction.

Table 26 presents the Spearman correlations between the online students' perceived distance from the other online students and the student-student interaction items ranked by the effect size. The calculated Spearman rho indicated that the students’ perceived distance to other students is significantly correlated with two out of the five items listed under the student-student interaction. The perceived distance to the other students negatively correlated with the following student-student interaction items: participating in course discussion (-0.39) and when the interaction with other students is perceived to enhance student learning (-0.29). Using Cohen’s (1988) guidelines for
interpreting effect size, online course discussion had a medium, whereas, enhancing the
learning process had a small effect size.

Table 26
Correlation between online students’ perceived distance from the other online learners
and student-student interaction items

<table>
<thead>
<tr>
<th>Student-Student Interaction Items</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>I participate in discussions with other students.</td>
<td>-0.39**</td>
</tr>
<tr>
<td>Interacting with other students enhances my learning.</td>
<td>-0.29*</td>
</tr>
<tr>
<td>I share course responsibilities with other learners.</td>
<td>-0.21</td>
</tr>
<tr>
<td>The course is an online learning community.</td>
<td>-0.18</td>
</tr>
<tr>
<td>I contact other students in the course via e-mail.</td>
<td>-0.09</td>
</tr>
</tbody>
</table>

Interaction Scale: 1= Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always.
Perceived Distance Scale: 1=very close, 2 = close, 3 = distant, 4 = very distant.
* p < 0.05. **p < 0.01.

The relationship between the perceived distance from the course content and student-content interaction.

Table 27 presents the Spearman correlations between the online students' perceived distance from the course content and the student-content interaction items ranked by the effect size. The calculated Spearman rho indicated that the students’ perceived distance to the content is significantly correlated with three out of the six items listed under the student-content interaction. The perceived distance to the online course content negatively correlated with the student-content interaction when the content is interesting (-0.38), includes accessible materials (-0.30) and when content is related to the learning objectives (-0.28). Using Cohen’s (1988) guidelines, interesting and accessible content had a medium size effect, whereas, content related to the learning objective had a small effect size.
Table 27

*Correlation between online students’ perceived distance from the course content and the student-content interaction items*

<table>
<thead>
<tr>
<th>Student-Content Interaction Items</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>The course content is interesting.</td>
<td>-0.38**</td>
</tr>
<tr>
<td>The course content includes accessible readings.</td>
<td>-0.30*</td>
</tr>
<tr>
<td>The course content is related to the learning objectives.</td>
<td>-0.28*</td>
</tr>
<tr>
<td>The course content provides information related to the real-life situations.</td>
<td>-0.21</td>
</tr>
<tr>
<td>The course content is ordered in such a way that makes learning easier.</td>
<td>-0.17</td>
</tr>
<tr>
<td>The course content is at a level appropriate for me.</td>
<td>-0.08</td>
</tr>
</tbody>
</table>

Interaction Scale: 1= Never, 2= Rarely, 3= Sometimes, 4= Often, 5= Always.

Perceived Distance Scale: 1=very close, 2=close, 3=distant, 4=very distant.

* p < 0.05. **p < 0.01.

**The relationship between the perceived distance from the course website and student-website interaction.**

Table 28 presents the Spearman correlations between the online students' perceived distance from the course website and the student-website interaction items ranked by effect size. The calculated Spearman rho indicated that the students’ perceived distance to the course website is significantly correlated with seven out of the eight items listed under the student-website interaction. The perceived distance to the online course website negatively correlated with the student-website interaction when the website is easy to navigate (-0.48), website is consistent throughout its pages (-0.40), technical support is provided as needed (-0.39), the website uses appropriate font sizes and colors (-0.39), the platform is appropriate for the subject matter (-0.33), accessing the platform from different devices (-0.33) and website is well organized (-0.25). Easy navigation, consistency, timely technical support, font size and color, the appropriateness of the platform, and accessibility of the platform had a medium size effect, whereas, organization of the website had a small effect size (Cohen, 1988).
Table 28

Correlation between online students’ perceived distance from the course website and the student-website interaction items

<table>
<thead>
<tr>
<th>Student-Website Interaction</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>The course website is easy to navigate.</td>
<td>-0.48**</td>
</tr>
<tr>
<td>The course website is consistent throughout its pages.</td>
<td>-0.40**</td>
</tr>
<tr>
<td>Technical support is provided as needed.</td>
<td>-0.39**</td>
</tr>
<tr>
<td>The course website uses appropriate font sizes and colors.</td>
<td>-0.39**</td>
</tr>
<tr>
<td>The course platform is appropriate for the subject matter.</td>
<td>-0.33**</td>
</tr>
<tr>
<td>I could access the learning platform from different devices.</td>
<td>-0.33**</td>
</tr>
<tr>
<td>The course website is well organized.</td>
<td>-0.25*</td>
</tr>
<tr>
<td>Technical support can be found in different channels.</td>
<td>-0.18</td>
</tr>
</tbody>
</table>

Note. * p < 0.05. **p < 0.01.

Interaction Scale: 1= Never, 2= Rarely, 3= Sometimes, 4= Often, 5= Always.
Perceived Distance Scale: 1=very close, 2=close, 3=distant, 4=very distant.

The Relationship Between Students’ Perceived Distance and Learner Autonomy

The relationship between the perceived distance from the instructor and learner autonomy.

Table 29 presents the Spearman rho correlations between the online students’ perceived distance from the instructor and learner autonomy items. The calculated Spearman rho indicated that there were no significant correlations between the students’ perceived distance to the instructor and any of the seven items listed under learner autonomy.

Table 29

Correlation between online students’ perceived distance from the instructor and their perceived learner autonomy items

<table>
<thead>
<tr>
<th>Learner Autonomy Items</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>I like to help other students.</td>
<td>0.14</td>
</tr>
<tr>
<td>I need collaborative learning.</td>
<td>0.14</td>
</tr>
<tr>
<td>I regard myself as an independent learner.</td>
<td>-0.09</td>
</tr>
<tr>
<td>I am able to develop a personal learning plan.</td>
<td>-0.08</td>
</tr>
<tr>
<td>I am a self-directed learner.</td>
<td>-0.06</td>
</tr>
<tr>
<td>I am able to find resources for study.</td>
<td>-0.04</td>
</tr>
<tr>
<td>I am able to learn without lots of guidance.</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Learner Autonomy scale: 1= Strongly disagree, 2= Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree.
Perceived distance scale: 1=very close, 2=close, 3=distant, 4=very distant.

* p < 0.05. **p < 0.01.
The relationship between the perceived distance from the other online students and learner autonomy items.

Table 30 presents the Spearman rho order for correlations between the online students' perceived distance from the other students and the learner autonomy items ranked by the effect size (ES). The calculated Spearman rho indicated that the students’ perceived distance to the other students is significantly and negatively correlated with two out of the seven items in the learner autonomy construct. As a student may be able to learn without a great deal of guidance, they perceived less distance to the other students (-0.32). Also, students who described themselves as self-directed learners felt less distance to the other students (-0.26). The ability of learning without lots of guidance had a medium size effect, whereas, self-directed learning had a small effect size (Cohen, 1988).

Table 30

*Correlation between online students’ perceived distance from the other online students and their perceived learner autonomy items*

<table>
<thead>
<tr>
<th>Learner Autonomy items</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am able to learn without lots of guidance.</td>
<td>-0.32**</td>
</tr>
<tr>
<td>I am a self-directed learner.</td>
<td>-0.26*</td>
</tr>
<tr>
<td>I am able to develop a personal learning plan.</td>
<td>-0.19</td>
</tr>
<tr>
<td>I regard myself as an independent learner.</td>
<td>-0.12</td>
</tr>
<tr>
<td>I need collaborative learning.</td>
<td>-0.10</td>
</tr>
<tr>
<td>I like to help other students.</td>
<td>-0.08</td>
</tr>
<tr>
<td>I am able to find resources for study.</td>
<td>-0.01</td>
</tr>
</tbody>
</table>

Learner Autonomy scale: 1= Strongly disagree, 2= Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree.
Perceived distance scale: 1=very close, 2=close, 3=distant, 4=very distant.
* p < 0.05. **p < 0.01.

The relationship between the perceived distance from the course content and learner autonomy items.

Table 31 presents the Spearman correlations between the online students' perceived distance from the course content and the learner autonomy items ranked by the effect size. The calculated Spearman rho indicated that the students’ perceived distance to
the course content is significantly correlated with four out of the seven items in the learner autonomy construct. The perceived distance to the course content negatively correlated with learner autonomy when the student is self-directed (-0.51), independent (-0.41), can learn without lots of guidance (-0.30) and can develop a personal learning plan (-0.28). Being a self-directed learner had a large effect size; whereas, being an independent learner, and the ability of learning without lots of guidance had medium effect size. However, the ability to develop a personal learning plan had a small effect size (Cohen, 1988).

Table 31
*Correlation between online students’ perceived distance from the course content and their perceived learner autonomy items.*

<table>
<thead>
<tr>
<th>Learner Autonomy items</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am a self-directed learner.</td>
<td>-0.51**</td>
</tr>
<tr>
<td>I regard myself as an independent learner.</td>
<td>-0.41**</td>
</tr>
<tr>
<td>I am able to learn without lots of guidance.</td>
<td>-0.30*</td>
</tr>
<tr>
<td>I am able to develop a personal learning plan.</td>
<td>-0.28*</td>
</tr>
<tr>
<td>I am able to find resources for study.</td>
<td>-0.21</td>
</tr>
<tr>
<td>I like to help other students.</td>
<td>-0.14</td>
</tr>
<tr>
<td>I need collaborative learning.</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Learner Autonomy scale: 1= Strongly disagree, 2= Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree.
Perceived distance scale: 1=very close, 2=close, 3=distant, 4=very distant.
* p < 0.05. **p < 0.01.

The relationship between the perceived distance from the course website and learner autonomy items.

Table 32 presents the Spearman rho order for correlations between the online students' perceived distance from the course website and the learner autonomy items ranked by the effect size. The calculated Spearman rho indicated that the students’ perceived distance to the course website was significantly correlated with five out of the seven items in the learner autonomy construct. The perceived distance to the course content negatively correlated with learner autonomy when the student is self-directed (-.51), can develop a personal learning plan (-0.42), the student is independent (-0.34),
can find resources for study (-0.32), and can learn without lots of guidance (-0.31). Being a self-directed learner had a large effect size; whereas, the ability to develop a personal learning plan, being an independent learner, the ability to find resources for study, and the ability of learning without lots of guidance had a medium effect size (Cohen, 1988).

Table 32
Correlation between online students’ perceived distance from the course website and their perceived learner autonomy items

<table>
<thead>
<tr>
<th>Learner Autonomy items</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am a self-directed learner.</td>
<td>-0.51**</td>
</tr>
<tr>
<td>I am able to develop a personal learning plan.</td>
<td>-0.42**</td>
</tr>
<tr>
<td>I regard myself as an independent learner.</td>
<td>-0.34**</td>
</tr>
<tr>
<td>I am able to find resources for study.</td>
<td>-0.32**</td>
</tr>
<tr>
<td>I am able to learn without lots of guidance.</td>
<td>-0.31**</td>
</tr>
<tr>
<td>I like to help other students.</td>
<td>-0.22</td>
</tr>
<tr>
<td>I need collaborative learning.</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Learner Autonomy scale: 1= Strongly disagree, 2= Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree.
Perceived distance scale: 1=very close, 2=close, 3=distant, 4=very distant.
* p < 0.05. **p < 0.01.

The relationship between the perceived distance from the course overall and learner autonomy items.

Table 33 presents the Spearman correlations between the online students' perceived distance from the course overall and the learner autonomy items ranked by the effect size. The calculated Spearman rho indicated that the students’ perceived distance to the course overall is significantly correlated with five out of the seven items in learner autonomy construct. The perceived distance to the course overall negatively correlated with learner autonomy items: the student is self-directed (-0.50), independent (-0.40), can learn without lots of guidance (-0.38), can develop a personal learning plan (-0.36), and can find resources for study (-0.35). Being a self-directed learner had a large effect size; whereas, being an independent learner, the ability to learn without lots of guidance, the
ability to develop a personal learning plan, and the ability to find resources for the study had a medium effect size (Cohen, 1988).

Table 33
*Correlation between online students’ perceived distance from the overall course and their perceived learner autonomy items*

<table>
<thead>
<tr>
<th>Learner Autonomy items</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am a self-directed learner.</td>
<td>-0.50**</td>
</tr>
<tr>
<td>I regard myself as an independent learner.</td>
<td>-0.40**</td>
</tr>
<tr>
<td>I am able to learn without lots of guidance.</td>
<td>-0.38**</td>
</tr>
<tr>
<td>I am able to develop a personal learning plan.</td>
<td>-0.36**</td>
</tr>
<tr>
<td>I am able to find resources for study.</td>
<td>-0.35**</td>
</tr>
<tr>
<td>I need collaborative learning.</td>
<td>-0.03</td>
</tr>
<tr>
<td>I like to help other students.</td>
<td>-0.00</td>
</tr>
</tbody>
</table>

Learner Autonomy scale: 1= Strongly disagree, 2= Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree.
Perceived distance scale: 1=very close, 2=close, 3=distant, 4=very distant.
*p < 0.05. **p < 0.01.

The Relationship Between the Perceived Distance and the Factors of Transactional Distance

Table 34 presents the Spearman correlations between the online students' perceived distance from the instructor, the other students, the course content, the course website, and the course overall with the transactional distance factors (course structure, interaction, and learner autonomy). Course structure was calculated using the summation of the participants’ perceptions regarding course structure items. Course interaction was calculated by the summation of the participants’ perceptions regarding items under student-instructor, student-student, student-content, and student-website interactions. Also, learner autonomy was calculated by the summation of the participants’ perceptions regarding autonomy items. Course structure was significantly correlated with all components of transactional distance. The course structure negatively correlated with perceived distance to the course website (-0.49), the instructor (-0.47), the course content
(-0.34). The effect size of these correlations is medium. In addition, the course structure negatively correlated with perceived distance to the other students (-0.24); this correlation had a small effect (Cohen, 1988). The calculated Spearman rho between the course structure and the perceived distance to the course overall was -0.46 (p < 0.01). The ES was medium. That means the more structure that online course has the less distance that students perceive to the instructor, other online students, course content, course website, and course overall.

Also, Table 34 indicates that learner autonomy is significantly correlated with all components of transactional distance, except the perceived distance to the instructor. Learner autonomy negatively correlated with perceived distance to the course website (-0.42) and the course content (-0.35). The effect size of these correlations is medium. In addition, learner autonomy negatively correlated with perceived distance to the other students (-0.24); this correlation had a small effect size (Cohen, 1988). The calculated Spearman rho between learner autonomy and the perceived distance to the course overall was -0.36 (p < 0.01). The effect size was medium. That means the more autonomy that online learners possess the less distance they felt to the other student, course content, course website, and course overall.

Moreover, Table 34 shows that interaction is significantly correlated with the perceived distance to the course website. Interaction negatively correlated with perceived distance to the course website (-0.39). Also, the results show that interaction is significantly correlated with the perceived distance to the course overall (-0.36); that is medium ES. That means the more interaction occurs in an online course the less distance that students felt toward course website and course overall.
Table 3
The relationship between the perceived distance and the factors of transactional distance

<table>
<thead>
<tr>
<th>Transactional Distance Factors</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Student-</td>
</tr>
<tr>
<td></td>
<td>Instructor</td>
</tr>
<tr>
<td>Course Structure²</td>
<td>-0.47**</td>
</tr>
<tr>
<td>Learner Autonomy²</td>
<td>-0.03</td>
</tr>
<tr>
<td>Interaction ³</td>
<td>-0.18</td>
</tr>
</tbody>
</table>

¹Scale: 1=very close, 2=close, 3=distant, 4=very distant.
²Scale: 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree.
³Scale: 1=never, 2=rarely, 3=sometimes, 4=often, 5=always.
* p < 0.05. ** p < 0.01.

Objective 6. Predicting the Transactional Distance by Course Structure, Dialogue, and Learner Autonomy

A multiple-linear-regression analysis was performed utilizing students’ perceived distance and students’ perceptions regarding the three factors to determine if the transactional distance can be predicted from the combination of these three factors. Table 35 presents the correlations of the Course structure, Course interaction, and Learner Autonomy (predictor variables) with the Overall Transactional Distance. Note that all the predictor variables are significantly correlated with the overall transactional distance (p< 0.01).
Table 35

Means, Standard Deviations, and Intercorrelations for the overall perceived distance and predictor variables (n=70)

<table>
<thead>
<tr>
<th>Variables</th>
<th>M</th>
<th>SD</th>
<th>Course Structure²</th>
<th>Course Interaction³</th>
<th>Learner Autonomy²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Transactional Distance¹</td>
<td>2.30</td>
<td>0.55</td>
<td>-0.54**</td>
<td>-0.50**</td>
<td>-0.41**</td>
</tr>
<tr>
<td>Predictor variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course Structure²</td>
<td>4.04</td>
<td>0.84</td>
<td>---</td>
<td>0.41**</td>
<td>0.32**</td>
</tr>
<tr>
<td>Course Interaction³</td>
<td>4.00</td>
<td>0.53</td>
<td>---</td>
<td>---</td>
<td>0.54**</td>
</tr>
<tr>
<td>Learner Autonomy²</td>
<td>3.96</td>
<td>0.52</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

¹Scale: 1=very close, 2=close, 3=distant, 4=very distant.
²Scale: 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree.
³Scale: 1=never, 2=rarely, 3=sometimes, 4=often, 5=always.
* p < 0.05. **p < 0.01.

Table 36 indicates that the multiple correlation coefficient (R), using all the predictors simultaneously, is 0.64 and the Adjusted R² is 0.38, meaning that 38% of the variance in the overall transactional distance can be predicted from the combination of the course structure, course dialogue, and learner autonomy. According to Cohen’s (1988) guidelines, this is a large effect in social and educational research. Also, table 36 shows that F = 14.94 and is statistically significant, p < 0.01. This indicates that the predictors significantly combine together to predict the overall transactional distance. Moreover, Table 36 shows the standardized beta coefficients. The t and p values for each independent variable indicate whether that variable is significantly contributing to the equation for predicting the overall transactional distance. Thus, course structure (t=3.71; p< 0.01), and course interaction (t=2.25; p< 0.05) are significantly adding to the prediction when all independent variables including learner autonomy are considered.
Table 3

Simultaneous Multiple Regression Analysis Summary for Course Structure, Course Dialogue, and Learner Autonomy Predicting Overall Transactional Distance (n=70)

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Structure</td>
<td>-0.25</td>
<td>0.07</td>
<td>-0.39</td>
<td>-3.71</td>
<td>0</td>
</tr>
<tr>
<td>Course Interaction</td>
<td>-0.28</td>
<td>0.12</td>
<td>-0.27</td>
<td>-2.25</td>
<td>0.03</td>
</tr>
<tr>
<td>Learner Autonomy</td>
<td>-0.15</td>
<td>0.12</td>
<td>-0.14</td>
<td>-1.25</td>
<td>0.22</td>
</tr>
<tr>
<td>Constant</td>
<td>5.02</td>
<td>0.46</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. R=0.64; Adjusted R²=0.38; F(3,66) = 14.94, p< 0.05

Objective 7. Instructional Design Aspects that Help to Reduce the Transactional Distance in Online Learning Environments

The fifth construct is related to 38 practices used in designing online courses. This construct consists of two sub-constructs (inclusion and importance). Participants were asked to report if an instructional design item is included in the online course that they are taking or not (1= included, 0= not included). Also, participants were asked to indicate the level of importance of the instructional design items to be included in the online courses (1= not important, 2= little importance, 3= moderate importance, 4= very important). Some participants did not respond to this question; thus, the number of responses varies.

Table 37 shows the instructional design items with high importance level (Mode=4) as reported by online students. Also, it shows the percentage of inclusion of these items. The online students indicated that well-organized syllabus, clear learning objectives, the instructor information, and printable materials are very important items in
their online course. All students (100%) stated that these items are included in their courses.

Table 37

**Very important instructional design items and the inclusion percentage**

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>Importance Mode</th>
<th>Inclusion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A well-organized syllabus.</td>
<td>62</td>
<td>4</td>
<td>100.0</td>
</tr>
<tr>
<td>Clearly defined learning objectives.</td>
<td>63</td>
<td>4</td>
<td>100.0</td>
</tr>
<tr>
<td>The instructor contact information on the course website.</td>
<td>63</td>
<td>4</td>
<td>100.0</td>
</tr>
<tr>
<td>Printable materials.</td>
<td>58</td>
<td>4</td>
<td>100.0</td>
</tr>
<tr>
<td>Descriptions of the assignments and directions on how and when to submit them.</td>
<td>61</td>
<td>4</td>
<td>98.4</td>
</tr>
<tr>
<td>Practical knowledge of the content.</td>
<td>59</td>
<td>4</td>
<td>98.3</td>
</tr>
<tr>
<td>A calendar with important course dates.</td>
<td>62</td>
<td>4</td>
<td>96.7</td>
</tr>
<tr>
<td>An overview of the sequence of the learning activities.</td>
<td>62</td>
<td>4</td>
<td>94.9</td>
</tr>
<tr>
<td>Weekly modules that include learning objectives, readings, assignments, quizzes and other weekly coursework.</td>
<td>62</td>
<td>4</td>
<td>93.3</td>
</tr>
<tr>
<td>Feedback regarding the coursework.</td>
<td>63</td>
<td>4</td>
<td>88.7</td>
</tr>
<tr>
<td>Demonstration of theories behind practical knowledge.</td>
<td>60</td>
<td>4</td>
<td>86.4</td>
</tr>
<tr>
<td>Information about software requirements.</td>
<td>58</td>
<td>4</td>
<td>84.7</td>
</tr>
<tr>
<td>Problem-solving approach.</td>
<td>60</td>
<td>4</td>
<td>84.7</td>
</tr>
<tr>
<td>Learning guides.</td>
<td>61</td>
<td>4</td>
<td>76.3</td>
</tr>
<tr>
<td>Rubrics for course activities.</td>
<td>61</td>
<td>4</td>
<td>71.0</td>
</tr>
<tr>
<td>Recorded video lectures.</td>
<td>57</td>
<td>4</td>
<td>67.8</td>
</tr>
</tbody>
</table>

¹Importance scale: 1= not important, 2= little importance, 3= moderate importance, 4= very important.

²Inclusion scale 1= included, 0= not included.

Students also indicated that assignment description, content with practical knowledge, and course calendar are commonly included in their online courses (98.4, 98.3, and 96.7%, respectively). However, the students reported that although rubrics and recorded video lectures have high importance, the inclusion percentages of these items was 71% and 67.8%, respectively.

Table 38 shows the instructional design items with a moderate importance level (Mode=3) as reported by online students. Also, it shows the percentage of inclusion of these items. The online students indicated that opportunities for sharing ideas, discussion boards, and student introductions are moderately important in an online course. The
inclusion ranged between 88.3% to 96.4%. Even though the following items were rated as moderately important only 62.7% of students reported that instructional simulations were included, 50.8% of students reported that peer feedback was included, 46.7% of students reported that frequently asked questions were included, and 40.3% of students reported that hands-on projects were included in their courses.

Table 38
Moderately important instructional design items and the inclusion percentage

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>Importance¹</th>
<th>Included² (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each student can share ideas with other students.</td>
<td>60</td>
<td>3</td>
<td>96.4</td>
</tr>
<tr>
<td>Discussion board.</td>
<td>63</td>
<td>3</td>
<td>95.2</td>
</tr>
<tr>
<td>Student introduction at the beginning of the online course</td>
<td>62</td>
<td>3</td>
<td>88.3</td>
</tr>
<tr>
<td>Technical support.</td>
<td>58</td>
<td>3</td>
<td>88.1</td>
</tr>
<tr>
<td>Weekly discussion board.</td>
<td>62</td>
<td>3</td>
<td>86.9</td>
</tr>
<tr>
<td>Required textbook.</td>
<td>57</td>
<td>3</td>
<td>81.0</td>
</tr>
<tr>
<td>The instructor biography on the course website.</td>
<td>63</td>
<td>3</td>
<td>80.6</td>
</tr>
<tr>
<td>Learners select their own sources.</td>
<td>60</td>
<td>3</td>
<td>71.2</td>
</tr>
<tr>
<td>Learners get the opportunity to lead discussions.</td>
<td>60</td>
<td>3</td>
<td>71.2</td>
</tr>
<tr>
<td>Instructor participation in discussions.</td>
<td>63</td>
<td>3</td>
<td>71.0</td>
</tr>
<tr>
<td>A tutorial video about how to use the platform.</td>
<td>57</td>
<td>3</td>
<td>67.2</td>
</tr>
<tr>
<td>External web pages, such as YouTube.</td>
<td>58</td>
<td>3</td>
<td>63.3</td>
</tr>
<tr>
<td>Instructional simulations.</td>
<td>60</td>
<td>3</td>
<td>62.7</td>
</tr>
<tr>
<td>Peer evaluation and feedback.</td>
<td>57</td>
<td>3</td>
<td>50.8</td>
</tr>
<tr>
<td>Frequently asked questions (FAQ).</td>
<td>62</td>
<td>3</td>
<td>46.7</td>
</tr>
<tr>
<td>Hands-on projects.</td>
<td>62</td>
<td>3</td>
<td>40.3</td>
</tr>
</tbody>
</table>

¹Importance scale: 1= not important, 2= little importance, 3= moderate importance, 4= very important.
²Inclusion scale 1= included, 0= not included.

Table 39 shows the instructional design items with little importance level (Mode=2) as reported by online students. Also, it shows the percentage of inclusion of these items. The online students indicated that three instructional design items, that are related to interaction, were of little importance. These items were online chat or video conferences, group assignments, and group projects. The inclusion percentages for these items were low; 47.7%, 44.1%, 39.7% respectively. The instructional design items least
likely to be included were weekly quizzes (35.5%), student suggested readings (33.9%), and student suggested topics (15%).

Table 39

*Instructional design items with little importance and the inclusion percentage*

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>Importance¹</th>
<th>Inclusion² (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online chats or video conferences.</td>
<td>58</td>
<td>2</td>
<td>47.7</td>
</tr>
<tr>
<td>Group-based assignments.</td>
<td>60</td>
<td>2</td>
<td>44.1</td>
</tr>
<tr>
<td>Group-based projects.</td>
<td>58</td>
<td>2</td>
<td>39.7</td>
</tr>
<tr>
<td>Weekly quizzes.</td>
<td>62</td>
<td>2</td>
<td>35.5</td>
</tr>
<tr>
<td>Students suggest readings for the class.</td>
<td>60</td>
<td>2</td>
<td>33.9</td>
</tr>
<tr>
<td>Students suggest topics for the class.</td>
<td>57</td>
<td>2</td>
<td>15.0</td>
</tr>
</tbody>
</table>

¹Importance scale: 1= not important, 2= little importance, 3= moderate importance, 4= very important.

²Inclusion scale1= included, 0= not included.

**Summary of Findings**

**Demographic characteristics:**

The findings of the study indicated that a majority of the respondents (59.7%) were male. 83.9% of them hold a bachelor’s degree. 82.3% of the participants were full-time employees and 71% of them were part-time students. Agronomy (35.5%) and Agricultural Education (30.6%) were the primary majors that participants came from. The mean number of previous online courses students had taken was 5.69 (SD=3.84).

**Perceived distance:**

The majority (60%) of the participants perceived other students as “distant”. Although 51.4% participants perceived their instructors as “close” 40% of them perceived their instructors as “distant”. The majority of the participants perceived course content and website as “close” or “very close”. Perceived distance from the instructor had a significant negative relationship with the number of online course student had taken.
Students majoring in Agronomy, Seed Technology, and Plant Breeding perceived less distance from the instructor, course content, and course overall when compared to students from other majors.

**Course structure, interaction, autonomy:**

In general perceptions regarding course structure were positive. Means ranged between 3.62 – 4.27 on a 5-point scale ranging from “strongly disagree” to “strongly agree”. Statements related to flexibility, course calendar, and learning objectives were the items that got the most agreement. Course structure had significant negative relationships with all aspects of perceived distance (student-student, student-instructor, student-content, student-website, and student-course overall).

Means for items related to student-instructor interaction ranged between 3.8 – 4.5 on a 5-point scale ranging from “never” to “always”. Contacting by email, encouraging participation, and providing sufficient information were the most frequent student-instructor interaction items. Regarding student-content interaction, means ranged between 3.97 – 4.34 on a 5-point scale ranging from “never” to “always”. Relevance, accessibility, and suitability were the most frequent student-content interaction items. Perceptions regarding student-website interaction were the highest among types of interaction. Means ranged between 3.99 – 4.33 on a 5-point scale ranging from “never” to “always”. Suitability of font, consistency, and well organization were the most frequent student-website interaction items. Student-student interaction was the lowest among interactions types. The perceptions means ranged between 2.24 – 3.83 on 5-point scale ranging from “never” to “always”. Discussion, feeling of the learning community, interaction enhance learning, were the most frequent student-student interaction items. In the other hand,
sharing responsibilities, contact other students by email were the least frequent interaction items. Course interaction had significant relationships with only student-website and student-course overall; and the relationships were negative.

The findings showed that student possess a high level of Autonomy. Means ranged 3.09 - 4.36 on 5-point scale ranging from “strongly disagree” to “strongly agree”. Finding learning resources, developing a study plan, and being self-directed were the items that got the most agreement. However, helping others and collaborative learning were the items with the least agreement. Autonomy had significant negative relationships with perceived distance from other students, course content, course website, and course overall.

A multiple-linear-regression was used to determine if students’ perceived distance could be predicted from the combination of course interaction, course structure, and learner autonomy. The squired multiple correlation coefficient revealed that 38% of the variance in the overall transactional distance could be predicted from course structure, course interaction, and learner autonomy.

**Instructional design:**

Instructional design items were categorized into three groups (very important, moderately important, little importance). The inclusion rate for very important items ranged between 67.8% to 100%. Very important items included a well-organized syllabus, clearly defined learning objectives, the instructor contact information, and Printable materials. The inclusion rate for moderately important items ranged between 40.3% to 96.4%. Moderately important items included share ideas with other students, discussion board, and student introduction at the beginning of the online course. The
inclusion rate for little important items ranged between 15% to 47.7%. Little important items included video conferences, group-based assignments, and group-based projects.
CHAPTER 5: SUMMARY, DISCUSSION, THEORETICAL IMPLICATIONS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents a summary, discussion, theoretical implications, conclusions, and recommendations for future research.

Summary of the Study

The development of information and instructional technology during the last two decades have had an impact on the transformation towards web-based distance education (Saba, 2011). The development of online learning provides open educational resources that include necessary knowledge and skills not only for higher education but also, for lifelong learning and professional development. Moreover, online education reshapes learners and educators thinking regarding the educational process (García-Barriocanal et al., 2013). Nowadays, online learning solutions not only provide options for on-campus students to take their courses but also, provide learning opportunities for those who cannot participate in traditional education settings. The success of distance education depends on the ability of educational programs to integrate technology in order to personalize the educational processes, which increases the effectiveness and the efficiency of the online learning (Burgess, 2006; Saba, 1999).

Research Objectives

The purpose of this study was to describe relationships between factors that influence perceived transactional distance (course structure, course interaction, and learner autonomy) and instructional design aspects that help to reduce transactional distance from the learner's perspective. This study addressed the following research objectives:
1. Describe the demographic characteristics of students in online graduate programs in the College of Agriculture and Life Sciences at Iowa State University.

2. Identify the extent to which learners feel they are distant from their online course (i.e. instructor, other learners, course content, and course interface).

3. Describe the relationship between learners’ perceived distance and their demographic characteristics.

4. Explore the online learners’ perceptions regarding the factors of transactional distance (i.e. course structure, course interactions, and learner’s autonomy).

5. Describe relationships between online students’ perceived distance and factors of transactional distance (course structure, interactions, and learner autonomy).

6. Predict perceived distance using course structure, dialogue, and learner autonomy.

7. Identify instructional design aspects that help to reduce the transactional distance in online learning environments.

**Research Methodology**

The population for the study consisted of all graduate students who enrolled in online courses in the CALS at Iowa State University during the fall semester of 2017. There were 271 graduate students enrolled in six different online programs in the CALS.

The questionnaire was built according to Radhakrishna’s (2007) recommendations. The first construct asked the participants to indicate the perceived distance that they felt toward the instructor, the other online learners, the course content, the course website, and the course overall. In the second construct, the participants
indicated their level of agreement with ten statements related course structure based on their experience in an online course that they were taking during the current semester. The third construct was related to dialogue in online courses. This construct had four sub-constructs representing four different types of interaction in online learning environments (student–instructor interaction, student-student interaction, student–content interaction, student–website interaction). Learner autonomy was the fourth construct. Learners were asked to indicate their level of agreement with statements that described their learning autonomy as online learners.

The fifth construct was related to practices used in designing online courses. This construct consisted of two sub-constructs (inclusion and importance). The last section of the questionnaire focused on the demographic characteristics of the participants.

After obtaining an approval from the Institutional Review Board (IRB) (Appendix B), a pilot test for the survey was conducted with graduate students who have taken at least one online course at Iowa State University (n=20). A reliability analysis was performed to examine the internal consistency of the five constructs in the survey.

A list of the online students who enrolled in agriculture online programs during the fall semester of 2017 was obtained from the Brenton Center for Agricultural Instruction and Technology Transfer. The data collection process occurred within the Qualtrics platform. This program has built-in features for tracking and keeping records of those who completed the questionnaire. The data collection process was conducted between October 2 and October 29, 2017. By the end of the data collection process, 80 online students responded to the survey. Ten responses were eliminated because they failed to complete at least 70% of the survey. Thus, 70 responses were usable. A final
response rate of 26% (n=70) was obtained. Respondents from the pilot study are not included in this summary or analysis.

The data were exported from Qualtrics to SPSS (25.0). Descriptive statistics such as means, frequencies, percentages, and standard deviations were used to analyze the data and report the findings of the study. In addition, correlations and multiple-linear-regression were used to analyze and report the relationships between variables of the study.

**Summary of Findings and Discussion**

**Demographic Characteristics**

There were 37 (59.7%) males and 25 (40.3%) females. The Bachelor’s degree was the highest educational level for 52 online students (83.9%). There were seven respondents who indicated a Master’s degree as their highest educational level (11.3%). In addition, one student had received a Ph.D. (1.6%), one student had received an associate degree (1.6%), and one student had received a professional degree (1.6%). There were 51 (82.3%) full-time employees, four participants were part-time employees (6.5%), six participants were unemployed (9.7%) and one (1.6%) was self-employed. While there were 44 (71%), full-time students, there were 18 part-time students (29%). Of the participants, 35.5% indicated a M.S. in Agronomy as their current major. A M.S in Agricultural Education came in the second with 19 participants (30.6%). A M.S. in Seed Technology and Business was indicated by 11 participants (17.7%) as their current major and six participants (9.7%) indicated a M.S. in Plant Breeding as their current area of study. The last two majors were Graduate Certificate in Food Safety & Defense with three students (4.8%) and M.S. in Agricultural Business and International Agriculture
with only one student (1.6%). The total number of online courses that participants (n=62) had taken ranged from 1-20 courses. The mean number of online courses was 5.69 (SD=3.84). The highest number of respondents (n=36, 58.1%) have taken between 1-5 online courses. There were 21 respondents (33.9%) who indicated they have taken 6-10 and four respondents (6.4%) indicated they have taken 11-15 online courses. Only one student indicated that he or she has taken more than 15 online courses.

**Perceived Distance**

The perceived distance to the other online learners was the highest comparing to the perceived distance from instructor, course content, course website, and course overall. Most of the participants (67.1%) indicated that they felt the other learners are distant or very distant from them. The perceived distance to the online instructor was higher than the perceived distance from course website and course content. Although 51.4% of the participants stated that the instructor is close to them, 45.7% indicated that they felt the instructor was distant or very distant. 14.3% of the participants indicated that the course content was distant. Only 11.7% of the participants indicated that they felt the course website was distant or very distant. Regarding overall perceived distance 28.6% of the online students in this study indicated that they felt the online course that they were taking was distant (25.7%) or very distance (2.7%).

**The Relationship Between the Demographic Characteristics and Perceived Distance**

Although Chen (2001) did not find that the number of previous online courses had a significant impact on perceived transactional distance, the results of this study supported the findings of House et al. (2007). The Spearman rho revealed a negative relationship between the number of online courses taken and the perceived distance to the
instructor. The Cramer’s V indicated that the perceived distance to the instructor had a strong association with students’ academic major. Also, the results show that the perceived distance to the course content had a strong association with the academic major. In addition, there was a strong association between the perceived distance to the overall course and student's academic major. However, the results do not show any significant association between the perceived distance from the other online learners and the perceived distance from the course website with any demographic characteristics. Also, there was no significant association between gender, educational level, employment, and student status with perceived distance.

**Participants’ Perceptions Regarding Course Structure**

The students’ perceptions regarding the course structure items were positive. Participants considered their online courses as highly structured courses. The calculated Spearman rho indicated that the students’ perceived distance to the instructor and to the website were significantly and negatively correlated with all course structure items, except “course calendar”. The students’ perceived distance to the other online students was significantly and negatively correlated with the following statements “engaging learning environment” and “appropriate number of activities in an online course”. The perceived distance to the course content was significantly and negatively associated with the following course structure items: “engaging learning environment,” “course syllabus,” “relevant activities,” “clear objectives,” and “helpful learning activities.” In general, the students’ perceived distance to the course overall is significantly and negatively correlated with all course structure components.
As stated in McBrien et al. (2009) that course structure terms such as “course rigidity” and “flexibility” are complex to understand. Therefore, the study used words such as “clear and appropriate” with specific course structure items to help participants describe the online course that they were taking. Goel et al. (2012) emphasized that, from the learners’ perspective, interaction was the dominant factor for perceived transactional distance. In fact, the findings of the current study disagree with that study in this regard. Moreover, the findings of the current study align with Huang et al. (2015) in finding that the content-learner and interface-learner interactions were related to the course structure more than course interaction. Hauser et al. (2012) mentioned that the course structure and student autonomy aspects were more influential in the online medium.

**Participants’ Perceptions Regarding Course Interaction**

In terms of course interaction, participants considered the student-website and student content interactions in their online courses were very high. The results showed that the students’ perceptions regarding the eight items focused on student-website interaction were positive. The perceived distance to the online course website negatively correlated with perceived ease of navigation, perceived consistency throughout its pages, perceived availability of technical support, perceived appropriateness of font sizes and colors, appropriateness for the subject matter, accessing the platform from different devices, and website organization.

The students’ perceptions regarding the six student-content interaction items were positive. The perceived distance to the course content negatively correlated with the following student-content interaction items: “the content is interesting,” “includes accessible materials,” and “content is related to the learning objectives.”
Student perceptions regarding the eight items focused on student-instructor interaction were positive. The perceived distance to the instructor negatively correlated with the following student-instructor interaction items: “the instructor enhances the students learning,” “the instructor provides appropriate assistance,” and “the instructor encourages students to participate in course activities.” These findings support Merrills’s (2010) findings that students depend primarily on written online communication tools including emails, discussions, and class notes. Also, these findings are consistent with Giossos et al. (2016) that the understanding of statements such as “the teacher knows that the students need help in their studies,” and “the students need encouragement to participate in the course activities,” improves student-instructor interaction in online learning environments.

Student-student interaction was the least frequently occurring compared to other types of interactions. The perceived distance to the other students negatively correlated with the following student-student interaction items: “I participate in a course discussion” and “interaction with other students enhances learning.” Results show the online students depended on the student-website, student-content, and student-instructor interactions more than the student-student interaction in their learning.

Findings indicated website-student was the interaction type with the most influence on perceived transactional distance, followed by the student-content, student-teacher, and lastly student-student interaction. This supports and McIsaac and Gunawardena (2004), Hoskins (2012), and Nwankwo (2013) who emphasized the importance of educational technology in improving students’ engagement, achievements, satisfaction, and retention in the online learning environments.
Participants’ Perceptions Regarding Learner Autonomy

Results indicated that online students in this study possessed a high level of autonomy. Most of the participants (90%) described themselves as self-directed learners and 81.4% of the participants described themselves as independent learners. However, only 31.4% of the students indicated their need for collaborative learning. The calculated Spearman rho indicated that there was not a significant correlation between the students’ perceived distance to the instructor with any of the seven items listed under learner autonomy. This does not align with Burgess (2006) who found that there is a positive relationship between learner autonomy and student perception of student-instructor interaction.

However, self-directed learners who can learn without a great deal of guidance perceived less distance to the other students. Also, the findings revealed that the independent and self-directed learners who were able to learn without a great deal of guidance and could develop a personal learning plan perceived distance to the course content and the course website less than other students. This finding supports Andrade (2014) who suggested that self-regulated learning should be emphasized in online course structure and interaction plans at an early stage of any distance education program.

Predicting Transactional Distance From Course Structure, Interaction, and Learner Autonomy

The multiple correlation coefficient (R) was 0.64 and the Adjusted R² was 0.38, meaning that 38% of the variance in the overall transactional distance can be predicted from the combination of course structure, course dialogue, and learner autonomy.
According to Cohen’s (1988) guidelines, this is a large effect in social or educational research.

This study supports Peters (2007), Saba and Shearer (1994), and Moore and Kearsley (2005) in finding that course structure, interaction, and learner autonomy influence transactional distance. Although the researchers in distance education have an agreement regarding the influence of the three factors on transactional distance, there is no consensus about the nature of the relationship between course structure and transactional distance and between course structure and other factors (dialogue or interaction and learner autonomy). Saba and Shearer (1994), Saba (2002), Moore and Kearsley (2005), Murphy et al. (2008), and Goel et al. (2012) support the Transactional Distance Theory; which indicates a positive correlation between course structure and transactional distance and a negative correlation between the course structure and interaction. However, the findings of this study indicated that high structure can help to reduce the perceived transactional distance in online courses. Also, the high structure enhances student-website, student-content, and student-instructor interaction. Thus, the findings of the current study support Deng and Yuen (2009) that the ideal compilation of transactional distance factors (structure, interaction, and learner autonomy) should not be an either-or situation, rather, interaction, course structure, and learner autonomy must be adjusted based on learning objectives, pedagogical needs, and student characteristics.

**Instructional Design and Transactional Distance**

Regarding the instructional design practices that help to reduce the transactional distance, the online students indicated that a well-organized syllabus, clear learning objectives, the instructor contact information, and printable materials were very important
items in their online course. Also, they indicated that opportunities for sharing ideas, participation in discussion board, and student introduction were moderately important in an online course. The online students indicated that instructional design items which were of little importance included: online chat or video conferences, group assignments, and group projects.

The participants in this study aligned with participants of previous studies regarding instructional design items. The findings aligned with Wold (2011) that course structure should include space to address goals and learning objectives and space for students to ask questions regarding specific information or general issues. In addition, the findings aligned with Smith et al. (2008) that timely feedback, a problem-solving approach, and rubrics for course activities were important items for online courses. Yates (2014) listed the course calendar as an important tool in online courses. Weekly modules are important according to Joo et al. (2014). Kanuka (2001) and Garthwait (2014) indicated that appropriate feedback and clear instructional sequence improved the learning process in online learning environments. Nordin et al. (2016) stated that recorded video lectures enhance online learning experience.

The Findings Within the Agricultural Distance Education

The study serves the first dimension of research that is suggested by Roberts and Dyer (2005); which is the practices of distance education in agriculture. The findings of the study agree with Benson et al. (2005) that online students felt “close” to their instructor and programs. The participants in this study and the participants in House, Weldon, and Wysocki (2007) indicated that the online courses provide a flexible learning experience. Thus, the findings support Menalled et al.’s (2009) conclusion that the
flexibility and interactivity in the online learning environments encourage learners to participate actively. Also, regarding the interactivity in online courses, the findings support Murphy (2002) about the importance, benefits, and usefulness of the course website and the course content.

In Conner et al. (2014) the quality and the structure of online learning motivated students to engage in the learning experiences. Likewise, course structure is the dominant factor for students to engage and stay connected to the online courses. Furthermore, the findings align with Moore et al. (2016) that the majority of the students did not like or want student-to-student interaction in online courses. In fact, the findings support Miller (1997) that the online students in agricultural education are independent and possess a high level of learning autonomy.

Swan et al. (2005) and Murphrey et al. (2012) stated that online students prefer a video communication tool and timely feedback most. Whereas, Kuna (2012) found that the discussion board and content management tools were most useful and most frequently used in online learning management systems. The findings of this study indicated that recorded video lectures, timely feedback, and discussion boards were among the most used instructional design items. On the other hand, the findings in this study do not align with Strong et al. (2012) regarding collaborative projects and assignments among learners. Group-based assignments and projects were among the least important instructional design items and their usage was little.

The findings of the study addressed some of the challenges facing distance education listed in Twigg (2001). The study findings related to course flexibility, learner-instructor interaction and learner autonomy may help to individualize distance education. Some
findings related to course structure and course interaction may help to improve the
gility of online learning. Also, the study included recommendations regarding how
course websites and content may help to increase accessibility in online learning.

**Theoretical Implications**

The distance education literature refers to the Transactional Distance Theory
when focusing on the social aspect of distance education. Moore & Kearsley (2005)
defines transactional distance as “the gap in understanding and communication between
the teachers and learners caused by a geographic distance that must be bridged through
distinctive procedures in instructional design and facilitation of interaction.” (p. 209).
Moore (1993) stated transactional distance may vary from one course to another. Also,
the perceived transactional distance may vary from one learner to another in the same
course.

According to Moore (1991; 1993) and Saba (2002), transactional distance is not
measured by the physical distance between the learners and their instructors but is
determined by the amount of structure that exists in the design of the course, the amount
of interaction that occurs between the learner and the instructor, and the degree of
autonomy that an individual learner possesses. While course structure refers to the
flexibility and the rigidity of the course design elements, dialogue refers to the amount of
two-way interaction between learners and instructors in the online learning environments
(Burgess, 2006). Zhang (2003) extended interaction in online learning and included
student-content and student-website interactions.

Moore (1993) stated there is an inverse relationship between course structure and
dialogue and between dialogue and transactional distance. The Transactional Distance
Theory indicated a positive relationship between course structure and transactional distance; and between course structure and learner autonomy. That means, high structured courses have high transactional distance and less interaction, thus, learners must exercise more autonomy.

The Transactional Distance Theory which guided the study was effective in assessing the online students’ perceptions of course structure, student-instructor interaction, student-student interaction, student-content interaction, and student-website interaction, as well as the online students’ perceptions of their learning autonomy. Moreover, the theory was effective in assessing the online student's perceived distance to the instructor, the other online students, the course content, and the course website.

This study confirms that course structure, interaction, and learner autonomy impacted perceived transactional distance. It was found that the computation of these three factors can explain 38% of the variance in the transactional distance in an online course. According to Cohen (1988), this is a large effect in social or educational research.

This study has some implications for the Transactional Distance Theory. First, although The Transactional Distance Theory indicates that there is a positive relationship between the course structure and the transactional distance (Figure 2), this study suggests a negative relationship between the course structure and the perceived transactional distance (Figure 3).
Figure 2. The relationship between course structure and transactional distance according to the theory.

Figure 3. The relationship between course structure and transactional distance according to the findings of this study.
Second, the Transactional Distance Theory indicates that there was a negative relationship between course structure and course interaction. However, this study indicated that a high level of interaction could be accommodated in highly structured online courses. Interaction in online courses can be manipulated during the design process. Figure 4 represents the negative relationship between structure, interactions, learner autonomy, and transactional distance. It shows that the more structure, interactions and learner autonomy in an online course the less transactional distance would be in that course. That means higher structure, higher interaction and higher learner autonomy help to lower the transactional distance.

Third, this study divided course interaction into four types of interactions (student-instructor, student-student, student-content, and student-website) and divided transactional distance into four components (distance from the instructor, distance from other online students, distance from the course content, and distance from the course website), which provides a comprehensive approach to study interaction and transactional distance in online courses.
Figure 4. The relationship between course structure, course interactions, learner autonomy and transactional distance.
Conclusions

The purpose of this study was to describe relationships between factors that influence perceived transactional distance (course structure, course interaction, and learner autonomy) and instructional design aspects that help to reduce transactional distance from the learner's perspective using Moore’s (1993) Transactional Distance Theory. Beside the implications on the Transactional Distance Theory, this study has implications for online learning practices and research. Findings from this study can be used to further the understanding of the social and educational aspects in online learning environments. The following conclusions were drawn from the study:

- The findings of this study indicated that there was a significant negative relationship between the number of previous online courses taken and the perceived distance from instructor. Thus, it can be concluded that students’ initial feelings of distance from instructors may subside as they experience additional online courses.

- The online students in Seed Technology and Business, Plant Breeding, and Agronomy programs felt less distance from their course overall compared to the students in Agricultural Education. Seed Technology and Business, Plant Breeding, and Agronomy programs had special coordinators that provide support for students at a distance. The difference between students’ feelings of distance may be caused by the support that students in the first three programs have. Online students in Agricultural Education do not have this type of support.

- The online students in Seed Technology and Business, Plant Breeding, and Agronomy programs felt less distance from instructors and course content
compared to students in Agricultural Education. It can be concluded that the perceived distance may vary between technical and social majors. Thus, the required amount of structure and interaction may vary according major and subject matter.

• Developing interaction strategies that enhance the learning process by providing appropriate academic assistance, establishing interaction moments among students, and encouraging students to participate in coursework may help to reduce student-instructor and student-student transactional distance.

• Developing interesting and attractive content that motivates students to learn, making sure that course content is organized and related to the learning objectives, and making sure that course content is accurate and accessible may help instructional designers reduce distance between online learners and course content.

• Elements that may help to reduce distance between learners and the course website include developing a well-organized website that is appropriate for the subject matter, consistent and easy navigation throughout its pages, appropriate font sizes and colors, accessibility from different devices, and providing technical support.

• Online learners are independent and self-directed in their learning. They are able to develop a personal learning plan and learn without lots of guidance. They feel less distance toward course content and the course website and more distance from their instructors and other online students.
From the students’ perceptions regarding course structure and their overall perceived distance, it can be concluded that high structure helps to reduce the transactional distance in online courses. More specifically, high structure reduces the distance that online students perceived from the course website, and content. An online course structure that includes clear objectives, syllabus, course calendar, and grading system helps students to feel more connected. Structure that provides engaging, flexible, and relevant activities also reduces transactional distance.

The most important instructional design elements in online courses include a well-organized syllabus, clear learning objectives, instructor’s contact information, printable materials, well-described assignments, practical knowledge, course calendar, clear learning sequence, weekly modules, and feedback. The inclusion rate for each one of these elements in online courses in this study was higher than 85%.

**Recommendations for Practice**

- Online educators should pay careful attention to their course structure because it may influence the amount of interaction and the level of autonomy for learners. Also, educators should understand that high course structure supplemented by high levels of dialogue might help to lower transactional distance in the online learning environments.

- Students with less experience in online learning perceived more distance toward their online courses. Therefore, it is recommended to provide a great amount of dialogue especially in introductory courses in online programs.
Students in programs that have special online coordinators feel more connected to their online courses. Therefore, it is recommended for academic departments that provide an online degree program to designate a coordinator who provides support to online students.

In order to bridge the gap that may exist between students and the instructor in online learning environments, instructors should develop communication plans to interact with their students. This plan should focus on enhancing the learning process and encouraging students to participate in coursework. Also, instructors should design student-student interaction that provides opportunities to make students feel more connected and enhance their learning as a group.

The findings of this study showed that student-content and student-website interactions play an important role in online learning environments. According to the findings, interesting, attractive, accurate, relevant, and accessible content and websites are significantly related to student-content and student-website transactional distance. Therefore, online instructors and instructional designers should develop online course content and websites according to these features.

Regarding the course website, online educators should check the organization of their websites. They should ask questions such as: Is the website appropriate for the subject matter? Is it consistent and easy to navigate throughout its pages? Is the website accessible from different kinds of devices? And what technical support is provided to the students?

When designing online courses, it is recommended to develop engaging and flexible courses that include a well-organized syllabus, clear learning objectives,
instructor’s contact information, printable materials, well-described assignments, practical knowledge, course calendar, a clear learning sequence, weekly modules, and feedback.

**Recommendation for Future Research**

- The theoretical framework for this study was the Transactional Distance Theory. It is recommended to study online course structure and interaction using different theoretical and/or conceptual frameworks. Relevant theories related to course structure include Sando’s (2005) course structure measurement, SREB’s (2006) evaluation, or Quality Matter’s (2017) standards. Course interaction can be studied using Activity Theory or Sociocultural Theory. Learner autonomy can be studied with Self-Regulated Learning Theory.

- This study was conducted only with graduate online students in the College of Agricultural and Life Sciences at Iowa State University. Therefore, it is recommended to replicate the study with different populations. The populations could include graduate and undergraduate students, online students in multiple colleges or universities, on-campus students who are taking some online courses and students who are enrolling in exclusively online programs. This would help to determine if the results are applicable to different populations.

- Results of the study show that compared to students in a social science major (Agricultural Education), students in technical majors (Seed Technology, Plant Breeding, and Agronomy) felt less distance toward their online courses. Further research is needed to investigate reasons behind the differences in perceived transactional distance between students in technical and social majors.
• More research should be conducted on course interaction in the online learning environments. Knowledge about the levels of student-instructor, student-student, student-content, and student-website interactions that students have experienced and their impact on learner satisfaction is needed.

• More research should be done to assess the impact of different course structures on variables such as student achievement and learning outcomes.

• Results of the study showed that student-student and student-instructor interactions significantly correlated with perceived distance. Therefore, additional research is needed to identify methods and styles that help to improve dialogue between students and instructors in online courses.
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APPENDIX A. SURVEY INSTRUMENT

Transactional Distance and Instructional Design in Agriculture Sciences Online Courses

Prepared by
Yahya S. Alotibi
2017
Part A. Perceived distance.

How distant or close do you feel toward the instructor, other online learners, the course content, the course website, and the course overall. Please use the 4-Point Scale (1=Very Distant, 2= Distant, 3= Close, 4= Very Close) to describe your connectedness.

<table>
<thead>
<tr>
<th>Item</th>
<th>Very Distant</th>
<th>Distant</th>
<th>Close</th>
<th>Very Close</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instructor.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other online learners.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course content.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course website.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall perceived distance.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Part B. Course Structure.

Please indicate your level of agreement with the following items based on your experience in an online course you are taking this semester. Please use the 5-Point Scale (1= Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly agree) to describe your agreement.

<table>
<thead>
<tr>
<th>Course Structure statements</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>My online course provides an engaging learning environment.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My online course provides a flexible learning experience.</td>
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</tr>
<tr>
<td>The subject matter is appropriate for online delivery.</td>
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<tr>
<td>The syllabus clearly states what I need to do throughout the semester.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The course has clear objectives.</td>
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<td></td>
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</tr>
<tr>
<td>The course calendar provides due dates for course activities (readings, discussions, assignments ...etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The number of activities (readings, discussions, assignments ...etc.) is appropriate.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The activities (readings, discussions, assignments ...etc.) are relevant.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The course provides activities (readings, discussions,</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
assignments,...etc.) that help me learn.
The grading system is clear.

**Part C. Course Interaction.**

Please indicate the frequency of the following interaction items based on your experience in an online course you are taking this semester. Please use the 5-Point Scale (1= Never, 2= Rarely, 3= Sometimes, 4= Often, 5= Always) to describe the frequency.

<table>
<thead>
<tr>
<th>Course Interaction statements</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instructor provides opportunities to discuss topics related to the subject matter.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>The instructor is available by email.</td>
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<tr>
<td>The instructor provides appropriate academic assistance.</td>
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<tr>
<td>The instructor provides sufficient information when I ask questions.</td>
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<tr>
<td>The instructor encourages me to participate in coursework.</td>
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<tr>
<td>The instructor provides timely feedback on coursework.</td>
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<tr>
<td>The instructor provides ample time for interaction.</td>
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</tr>
<tr>
<td>The instructor interaction enhances my learning.</td>
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<tr>
<td>The course is an online learning community.</td>
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<tr>
<td>I participate in discussions with other students.</td>
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<tr>
<td>I contact other students in the course via e-mail.</td>
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<tr>
<td>I share course responsibilities with other learners.</td>
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</tr>
<tr>
<td>Interacting with other students enhances my learning.</td>
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<td></td>
</tr>
<tr>
<td>The course content is interesting.</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>The course content includes accessible readings.</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>The course content provides information related to the real-life situations.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The course content is ordered in such a way that makes learning easier.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The course content is related to the learning objectives.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The course content is at a level appropriate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Part D. Learner Autonomy.**

The following items are focused on learner autonomy. Please indicate your level of agreement with each statement. Please use the 5-Point Scale (1= Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly agree)

<table>
<thead>
<tr>
<th>Learner Autonomy Statements</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am a self-directed learner.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am able to develop a personal learning plan.</td>
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<tr>
<td>I am able to find resources for study.</td>
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</tr>
<tr>
<td>I need collaborative learning.</td>
<td></td>
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</tr>
<tr>
<td>I regard myself as an independent learner.</td>
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<tr>
<td>I am able to learn without lots of guidance.</td>
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<td></td>
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<td></td>
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<tr>
<td>I like to help other students.</td>
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<td></td>
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</tr>
</tbody>
</table>

**Part E. Instructional Design.**

**Instructions:** The items in this section are practices used in designing online courses.

**Column A: Level of inclusion.** In column A, you are going to answer the following question: to what extent are the instructional design items included in the online course you
are taking?

**Column B: Level of Importance of being included.** In column B, you are going to answer the following question: to what extent do you think each instructional design item is important to be included in online courses?

*Please respond to each practice for both columns*

<table>
<thead>
<tr>
<th>Instructional Design Statements</th>
<th>Inclusion</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not Included</td>
<td>Included</td>
</tr>
<tr>
<td>Clearly defined learning objectives.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A well-organized syllabus.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A calendar with important course dates.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning guides.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>An overview of the sequence of the learning activities (readings, discussions, assignments ...etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequently asked questions (FAQ).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student introduction at the beginning of the online course.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly modules that include learning objectives, readings, assignments, quizzes and other weekly coursework.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Descriptions of the assignments and directions on how and when to submit them.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubrics for course activities.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hands-on projects.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly discussion board.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly quizzes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The instructor biography on the course website.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The instructor contact information on the course website.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feedback regarding the coursework.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discussion board.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructor participation in discussions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learners get the opportunity to lead discussions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Each student is able to share ideas</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
with others students.
Group-based assignments.
Group-based projects.
Peer evaluation and feedback.
Practical knowledge of the content.
Problem-solving approach.
Demonstration of theories behind practical knowledge.
Learners select their own sources.
Students suggest readings for the class.
Students suggest topics for the class.
Required Textbook.
Online chats or video conferences.
Recorded video lectures.
Printable materials (PowerPoint slides or/and PDF files).
External web pages, such as YouTube.
Instructional simulations.
A tutorial video about how to use the platform (Blackboard).
Technical support.
Information about software requirements.

<table>
<thead>
<tr>
<th>Part F. Learners’ Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender:</td>
</tr>
<tr>
<td>What is the highest educational degree you have already earned?</td>
</tr>
<tr>
<td>What is your current employment status?</td>
</tr>
</tbody>
</table>
Self-employed
Unemployed

**What is your current student status?**
- Part time
- Full time

**What is your current major?**
- M.S. in Agricultural Education
- M.S. in Agronomy
- M.S. in Community Development
- M.S. in Plant Breeding
- M.S. in Seed Technology and Business
- Graduate Certificate in Food Safety & Defense
- Certificate in Occupational Safety
- Certificate in Swine Science
- Other (specify): ............................

**A number of online courses you have taken:**
APPENDIX B. GUIDELINES TO PANEL OF EXPERT

Hello Dr. <the expert name>

I am a doctoral student in agricultural education from the Department of Agricultural Education and Studies at Iowa State University. Currently, I am in the third year of my studies and working with my major professor, Prof. Greg Miller.

The purpose of this letter is to ask for your help and invite you to serve as one of the panel of experts to evaluate the validity of my questionnaire.

The questions of this study are as follows:

- To what extent learners feel that they are connected to the online course (instructor, other learners, course content, and course interface)?
- What are online learners’ perceptions regarding components of the transactional distance (course structure, dialogue, and learner’s autonomy)?
- What affects do the components of transactional distance have on the perceived distance of the learners?
- What are instructional design aspects that help to reduce the transactional distance in online learning environments?
- Is there any relationship between learners’ perceived distance and their demographic characteristics?
- Your thoughtful response regarding face, content and construct validity will enable me to assure the validity of the instruments.

Attached are Panel of Expert Guidelines, and the Instrument (Questionnaire).

If you have questions about this study, do not hesitate to contact me at yalotibi@iastate.edu.

Thank you for your help and assistance are given.

--

Yahya S. Alotibi

Agricultural Education and Studies, Iowa State University

227 Curtiss Hall

Ames, IA 50011

yalotibi@iastate.edu
Learners' Perceptions regarding Transactional Distance in Agriculture Sciences

Online Courses Questionnaire
- Panel of Expert Guidelines -

The research questions of this study are:

- To what extent do learners feel that they are connected to the online course (i.e. instructor, other learners, course content, and course interface)?
- What are online learners’ perceptions regarding the components of transactional distance (i.e. course structure, dialogue, and learner’s autonomy)?
- What affects do the components of transactional distance have on the perceived distance of the learners?
- What are instructional design aspects that help to reduce the transactional distance in online learning environments?
- Is there any relationship between learners’ perceived connectedness and their demographic characteristics?

1. As you review the questionnaire, please consider whether each item is:
   ➢ Relevant to the objectives
   ➢ Clear and concise
   ➢ Not “multi-barreled”
   ➢ Free of technical jargon

2. Please review each of the items in the questionnaire. Indicate if each item should be:
   ➢ Retained as is (Requires no mark)
   ➢ Modified and retained (Make edits/comments on the questionnaire)
   ➢ Deleted (Marked through)
Part A. Transactional distance.
According to Moore (1991), Transactional Distance is the communication and psychological gap that is caused by the physical separation between instructors and their students in distance education programs, which leads to misunderstanding between the two parties. In the questionnaire, the learners are asked to indicate their perceived connectedness.

Please answer the following questions about the transactional distance scale.
1. Does it contain items that are consistent with the transactional distance definition (Construct validity)?
   Yes No
2. Do the items adequately represent the universe of items that could be used to measure transactional distance (Content validity)?
   Yes No
3. Does the scale look like it will measure transactional distance (Face validity)?
   Yes No

If you answered “No” to any of the three questions, please explain how the scale needs to change in order for you to be able to answer “Yes”.

Part B. Course Structure.
Course Structure is a description of the ways in which course elements (educational objectives, teaching strategies, learning activities, and evaluation plans) are developed. Also, it refers to the flexibility and the rigidity of a program (Moore, 1991).

Please answer the following questions about the course structure scale.
1. Does it contain items that are consistent with the course structure definition (Construct validity)?
   Yes No
2. Do the items adequately represent the universe of items that could be used to measure course structure (Content validity)?
   Yes No
3. Does the scale look like it works to measure course structure (Face validity)?
   Yes No
If you answered “No” to any of the three questions, please explain how the scale needs to change in order for you to be able to answer “Yes”.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Part C. Course Interaction.

Dialogue is a description of nature and the extent of the interaction between the learner and instructor (Moore, 1991). Zhang (2003) expanded the scope of dialogue within online courses to include, besides learner-instructor interaction, there are learner-learner, learner-content, and learner-interface interactions.

Please answer the following questions about the Dialogue scale.

1. Does it contain items that are consistent with the dialogue definition (Construct validity)?
   Yes                      No

2. Do the items adequately represent the universe of items that could be used to measure dialogue (Content validity)?
   Yes                      No

3. Does the scale look like it works to measure dialogue (Face validity)?
   Yes                      No

If you answered “No” to any of the three questions, please explain how the scale needs to change in order for you to be able to answer “Yes”.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Part D. Learner Autonomy.

Learner autonomy is the description of learner’s ability to take the responsibility for her/his own learning process. It, also, refers to the extent to which the learner is independent during the learning process (Moore, 1991).
Please answer the following questions about the learner autonomy scale.

1. Does it contain items that are consistent with the learner autonomy definition (Construct validity)?
   
   Yes  
   No

2. Do the items adequately represent the universe of items that could be used to measure learner autonomy (Content validity)?
   
   Yes  
   No

3. Does the scale look like it works to measure learner autonomy (Face validity)?
   
   Yes  
   No

If you answered “No” to any of the three questions, please explain how the scale needs to change in order for you to be able to answer “Yes”.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Part E. Instructional Design.

Please answer the following questions about the instructional design scale.

1. Does it contain items that are consistent with the instructional design aspects (Construct validity)?
   
   Yes  
   No

2. Do the items adequately represent the universe of items that could be used to measure instructional design (Content validity)?
   
   Yes  
   No

3. Does the scale look like it works to measure instructional design (Face validity)?
   
   Yes  
   No

If you answered “No” to any of the three questions, please explain how the scale needs to change in order for you to be able to answer “Yes”.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Email # 1: -Invitation to Serve as Participants for a pilot study

September 2nd, 2017

Greetings [First Name],

We are writing you about a very important study concerning factors that influence how distant or close online learners feel toward their instructors, other online learners, the course content, the course website and the course overall. Also, the study aims to identify the instructional design aspects that help to develop and improve online courses.

You were selected to participate because you are a student at Iowa State University who has taken at least one online course. Your response in this pilot study is very important because it will help the researchers to revise and improve the survey before sending out the final version of it. Also, your response might eventually help educators and instructional designers in the college develop and improve their online courses.

Your participation is voluntary, and you may withdraw your participation at any time without any consequences. All responses will be kept secure and confidential. There are no foreseeable risks from participating in this study.

If you have questions about this study, do not hesitate to contact us, Yahya S. Alotibi (317-529-8337), yalotibi@iastate.edu or Greg Miller (515-294-2583), gsmiller@iastate.edu.

Thank you very much for your participation.

Sincerely,

Yahya S. Alotibi
Graduate Student
Iowa State University

Greg Miller
Professor
Iowa State University
Email # 2: Pre-notice

September 28th, 2017

Dear [First Name],

In a few days, you will receive an e-mail requesting that you fill out a brief online questionnaire for an important research project being conducted at Iowa State University.

The purpose of this study is to determine the factors that influence how distant or close online learners feel toward the instructors, other online learners, the course content, the course website and the course overall. Also, the study aims to identify the most important instructional design aspects from the online learners’ perspective. Data from this study would help the College of Agriculture and Life Sciences to develop and improve its online courses.

We are sending this e-mail in advance because we know that many people like to know ahead of time that they will be asked to participate in a survey. Thank you for your time and consideration. It is only with the generous help of people like you that our research can be successful. **By completing the survey, you are eligible to win one of twenty Starbucks™ gift cards (each gift card worth ten dollars).**

If you have questions about this study, do not hesitate to contact us, Yahya S. Alotibi (317-529-8337), yalotibi@iastate.edu or Greg Miller (515-294-2583), gsmiller@iastate.edu.

Thank you very much for your participation.

Sincerely,

Yahya S. Alotibi  
Graduate Student  
Iowa State University

Greg Miller  
Professor  
Iowa State University
Email # 3: Invitation to Serve as Participants for a Research

October 2\textsuperscript{nd}, 2017

Greetings [First Name],

We would like to invite you to participate in an important study that will determine the factors that influence how distant or close online learners feel toward their instructors, other online learners, the course content, the course website and the course overall. The study aims to identify the instructional design aspects that help to develop and improve online courses.

You were selected to participate because you are an online student at College of Agriculture and Life Sciences at Iowa State University. Your response is very important because it might eventually help educators and instructional designers in the college to develop and improve their online courses. \textbf{By completing the survey, you are eligible to win one of twenty Starbucks\textsuperscript{TM} gift cards (each gift card worth ten dollars).}

Your participation is voluntary, and you may withdraw your participation at any time with no consequence. All responses will be kept secure and confidential. There are no foreseeable risks from participating in this study. You should be able to complete the questionnaire in approximately 15 minutes.

If you have questions about this study, do not hesitate to contact us, Yahya S. Alotibi (317-529-8337), yalotibi@iastate.edu or Greg Miller (515-294-2583), gsmiller@iastate.edu.

Thank you very much for your participation.

Sincerely,

Yahya S. Alotibi
Graduate Student
Iowa State University

Greg Miller
Professor
Iowa State University
Email # 4 - Reminders

October 9th, 16th, and 23rd, 2017

Dear [First Name]

A few days ago, we sent you a letter requesting your participation in a survey to determine the factors that influence how distant or close online learners feel toward their instructors, other online learners, the course content, the course website and the course overall.

If you have already completed the questionnaire, please accept our sincere thanks. If not please do so today. We are especially grateful for your help because it is only by asking people like you that we can help educators and instructional designers at the College of Agriculture and Life Sciences to develop and improve their online courses. Do not miss the chance to enter the drawing on twenty Starbucks™ gift cards.

If you have questions about this study, do not hesitate to contact us, Yahya S. Alotibi (317-529-8337), yalotibi@iastate.edu or Greg Miller (515-294-2583), gsmiller@iastate.edu.

Thank you very much for your participation.

Sincerely,

Yahya S. Alotibi
Graduate Student
Iowa State University

Greg Miller
Professor
Iowa State University
APPENDIX D. INSTITUTIONAL REVIEW BOARD APPROVAL

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
2420 Lincoln Way, Suite 202
Ames, Iowa 50014
515-294-4566

Date: 7/18/2017
To: Yahya S. Aliotibi
1422 Walton Dr, Unit 206
Ames, IA 50014

From: Office for Responsible Research

Title: Learners’ Perceptions regarding Transactional Distance and Instructional Design Aspects in Online Courses

IRB ID: 17-322

Study Review Date: 7/17/2017

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
  - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
  - Any disclosure of the human subjects’ responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- You do not need to submit an application for annual continuing review.

- You must carry out the research as described in the IRB application. Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. Only the IRB or designees may make the determination of exemption, even if you conduct a study in the future that is exactly like this study.

Please be aware that approval from other entities may also be needed. For example, access to data from private records (e.g., student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. An IRB determination of exemption in no way implies or guarantees that permission from these other entities will be granted.

Please don’t hesitate to contact us if you have questions or concerns at 515-294-4566 or irb@iastate.edu.
APPENDIX E

DESCRIPTION FOR ONLINE COURSES THAT WERE REGISTERED BY PARTICIPANTS IN FALL 2017

1. Agricultural Education Courses.

AGEDS 511: Professional Agricultural Presentation Practices.

(3-0) Cr. 3. F.SS. Prereq: Graduate Classification
The identification and use of key planning, delivery and evaluation of presentations using audience engagement techniques focused on research-based principles and field-based practices of professional presenters in agriculture and the life sciences.

AGEDS 524: Program Development and Evaluation in Agricultural and Extension Education.

(3-0) Cr. 3. F. Prereq: Graduate classification
Theories and practice of program planning for nonformal education. Addresses use of program logic modeling and considers critical theories of planning to address power and interests in program development, needs assessment, and evaluation.

AGEDS 550: Foundations of Agricultural Education.

(3-0) Cr. 3. F. Prereq: Graduate classification
Philosophical premises, ethical principles, historical development, contextual applications, and knowledge bases for agricultural education.

AGEDS 561: Technology Transfer and the Role of Agricultural and Extension Education.

(Dual-listed with AGEDS 461). (3-0) Cr. 3. S.
Impact of agricultural and extension education processes on development and their role in the transfer of agricultural technology. Utilizing situational analysis techniques to analyze and solve problems in international agricultural education programs.
Meets International Perspectives Requirement.
AGEDS 568X Qualitative Interviews and Analysis.

(3-0). Cr. 3. S. Prereq: Graduate status. Understanding the role of interviews in agricultural education research, basis for theory of meaning, and variations of interview technique among qualitative traditions. Development of facilitation technique for individual interviews; and focus groups. Transcription and basic qualitative analysis. Use of interview findings to prepare manuscripts.

2. Agronomy and Plant Breeding Courses

AGRON 501: Crop Growth and Development.*

(3-0) Cr. 3. F.S. Prereq: AGRON 181 or equivalent, MATH 140, CHEM 163, BIOL 101. Physiological processes in crop growth, development and yield: photosynthesis, respiration, water relations, mineral nutrition, assimilate partitioning, seedling vigor, light interception and canopy growth, root growth, reproduction and yield. Required course for the Master of Science in Agronomy degree program and Agronomy Graduate Certificate program.

AGRON 502: Chemistry, Physics, and Biology of Soils.

(3-0) Cr. 3. F. Alt. S., offered odd-numbered years. Prereq: AGRON 181 or equivalent, AGRON 182 or equivalent, BIOL 101, CHEM 163, MATH 140. Soil chemical, physical, and biological properties that control processes within the soil, their influence on plant/soil interactions, and soil classification. Basic concepts in soil science and their applications. Required course for the Master of Science in Agronomy degree program and Agronomy Graduate Certificate program.

AGRON 503: Climate and Crop Growth.

(3-0) Cr. 3. F.S. Prereq: AGRON 181 or equivalent and MATH 140. Applied concepts in climate and agricultural meteorology with emphasis on the climate-agriculture relationship and the microclimate-agriculture interaction and crop risk management. Basic meteorological principles are also presented to support these applied concepts. Required course for the Master of Science in Agronomy degree program and Agronomy Graduate Certificate program.

AGRON 506: Crop Genetics.*

(Cross-listed with HORT). Cr. 3. F. Introduction to genetics of reproductive systems, recombination, segregation and linkage analysis, inbreeding, quantitative inheritance, fertility regulation, and polyploidy to prepare students for subsequent courses in crop improvement. Enrollment is restricted to off-campus MS in Plant Breeding students.
AGRON 511: Crop Improvement.

(3-0) Cr. 3. F.S. Prereq: AGRON 181 or equivalent, MATH 140, CHEM 163, BIOL 101. Basic principles in the genetic improvement of crop plants. Methods of cultivar development in self-pollinated and cross-pollinated crop species. Required course for the Master of Science in agronomy degree program and agronomy graduate certificate program.

AGRON 512: Soil-Plant Environment.

(3-0) Cr. 3. S. Prereq: AGRON 502. Recommended AGRON 501. Soil properties and their impact on soil/plant relationships. Soil structure, aeration, moisture, and nutrients will be discussed in the context of soil fertility and environmental quality management. Required course for the Master of Science in agronomy degree program and agronomy graduate certificate program.

AGRON 513: Quantitative Methods for Agronomy.*

(3-0) Cr. 3. F.S. Prereq: AGRON 181 or equivalent, MATH 140, STAT 104. Quantitative methods for analyzing and interpreting agronomic information. Principles of experimental design, hypothesis testing, analysis of variance, regression, correlation, and graphical representation of data. Use of SAS and Excel for organization, analyzing, and presenting data. Required course for the Master of Science in Agronomy degree program.

AGRON 514: Integrated Pest Management.

(3-0) Cr. 3. F.S. Prereq: AGRON 181 or equivalent, AGRON 501, MATH 140, CHEM 163, BIOL 101; AGRON 502 and AGRON 503 recommended. Principles and practices of weed science, entomology, and plant pathology applied to crop production systems. Biology, ecology and principles of integrated crop pest management. Required course for the Master of Science in Agronomy degree program and Agronomy Graduate Certificate program.

AGRON 524: Applied Plant Molecular Genetics & Biotechnology.*

Cr. 3. F. Prereq: AGRON 506. Basic principles and applied techniques used in the genetic improvement of crop plants. Discussion of structure and function of genes that control traits of value. Types of molecular markers, analysis of quantitatively inherited traits, genome mapping, analyses of databases.

AGRON 531: Crop Ecology and Management.

(3-0) Cr. 3. F. Prereq: AGRON 501, AGRON 502, AGRON 503; AGRON 512 and AGRON 514 recommended.
Ecological principles underlying crop production systems. Crop production in the context of management approaches, system resources and constraints, and interactions. Emphasis on the ecology of row and forage crops common to the Midwest. Required course for the Master of Science in Agronomy degree program.

**AGRON 532: Soil Management.**

(3-0) Cr. 3. F. Prereq: AGRON 501, AGRON 503, AGRON 512. Recommended AGRON 513.
Evaluates the impact of various soil management practices on soil and water resources. Combines and applies basic information gained in AGRON 502 and AGRON 512. Emphasizes the agronomic, economic, and environmental effects of soil management strategies. Required course for the Master of Science in Agronomy degree program.

**AGRON 533: Crop Protection.**

(3-0) Cr. 3. F.SS. Prereq: AGRON 514.
Integrated management systems for important crop pests. Cultural, biological and chemical management strategies applicable to major crops grown in the Midwest. Required course for the Master of Science in Agronomy degree program.

**AGRON 544: Host-Pest Interactions.***

Cr. 3. F. Prereq: AGRON 501.
Incorporation of the principles of integrated pest management and crop protection. Management systems (biological, cultural, chemical) and strategies which practice principles of weed science, plant pathology, and entomology. Enrollment is restricted to off-campus students in Agronomy MS in Plant Breeding.

**AGRON 570: Risk Assessment for Food, Agriculture and Veterinary Medicine.**

(Cross-listed with TOX, VDPAM). (3-0) Cr. 3. F. Prereq: Statistics 300-level or higher.

**AGRON 592: Current Issues in Agronomy.**

(3-0) Cr. 3. F.S. Prereq: AGRON 501, AGRON 503, AGRON 511, AGRON 512, AGRON 513, AGRON 514.
Critical analysis and discussion of agricultural practices, programs, and policies of current interest to the field of agronomy. Leadership skill development through consideration of technical, social, and ethical components underlying controversial topics. Enhancement of communication proficiency through debate and writing in order
to define problems, articulate possible solutions, and propose appropriate courses of
action. Required course for the Master of Science in agronomy degree program.

*Offered for both Agronomy and Plant Breeding.

3. Food Science and Human Nutrition Courses.

FS HN 523: A Multidisciplinary Overview of Food Safety and Security.

(2-0) Cr. 2. F.SS. Prereq: A course in biology or chemistry; enrollment in GP-IDEA Food
Safety and Defense Graduate Certificate or permission of instructor.
Multidisciplinary food safety and security perspectives provided by numerous subject
matter experts. Topics include food safety policy, ag bioterrorism, border security, animal
ID, food defense and site security, risk analysis, crisis communication, epidemiology,
HACCP, and more. Offered online only.

FS HN 525: Principles of HACCP.

(2-0) Cr. 2. F. Prereq: Undergraduate biology and chemistry courses; enrollment in GP-
IDEA Food Safety and Defense Certificate or permission of instructor.
A comprehensive study of the Hazard Analysis and Critical Control Point System and its
application in the food industry. Offered online only.

FS HN 529: Foodborne Toxicants.

(Cross-listed with TOX). (2-0) Cr. 2. F. Prereq: A course in biochemistry; enrollment in
GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Mechanisms of action, metabolism, sources, remediation/detoxification, risk assessment
of major foodborne toxicants of current interest, design of HAACP plans for use in food
industries targeting foodborne toxicants, discussion of toxicants from a food defense
perspective. Offered online only.

4. Seed Technology and Business.

STB 510: Crop Improvement.

(Cross-listed with AGRON). (3-0) Cr. 3. Prereq: Admission to the Seed Technology and
Business Master's Degree Program or approval of the instructor.
A study of the basic principles and methods in the genetic improvement of crop plants.
Methods used in manipulating genomes through the use of biotechnology. Methods of
cultivar development. Quantitative procedures for describing response to selection.
Analysis of the relationship of reproductive characters and growth characteristics to
response to selection.
STB 536: Quantitative Methods for Seed.

(Cross-listed with AGRON). (2-0) Cr. 2. F. Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor. Quantitative Methods for analyzing and interpreting agronomic and business information for the seed industry. Principles of experimental design and hypothesis testing, regression, correlation, analysis of variance, and graphical representation of data. Use of spreadsheets and statistical software for manipulating, analyzing and presenting data.

STB 539: Seed Conditioning and Storage.

(Cross-listed with AGRON). (2-0) Cr. 2. Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor. The technical operations which may be carried out on a seed lot from harvest until it is ready for marketing and use. The opportunities for quality improvement and the risks of deterioration which are present during that time. Analysis of the costs of and benefits of operations. Evaluation of equipment based on benefits to the customer and producer. Interpretation of the role of the conditioning plant and store as focal points within the overall operations of a seed company.

STB 543: Seed Physiology.

(Cross-listed with HORT). (2-0) Cr. 2. Alt. F., offered even-numbered years. Prereq: Admission to the Graduate Seed Technology and Business Program or approval of the instructor. Brief introduction to plant physiology. Physiological aspects of seed development, maturation, longevity, dormancy and germination. Links between physiology and seed quality.