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A Study Of Digital Communication Tools Used In Online High School Courses

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A STUDY OF DIGITAL COMMUNICATION TOOLS USED IN ONLINE HIGH SCHOOL COURSES

by

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ABSTRACT

The purpose of this study was to determine the degree to which selected communication tools used by teachers who teach online are positively perceived by their students in improving feelings of self-efficacy and motivation, and which tools may be perceived to be significantly more effective than the others. Students from the Florida Virtual School, a leader in online course delivery for grades 6-12, were surveyed to find their perceptions about how their teachers' use of email, Instant Messaging, chat, the telephone, discussion area, whiteboard, and assignment feedback affected their motivation and success in an online high school course. Correlations were done to discover if there were any significant relationships between variables that relate to teacher interaction and motivation. In addition, distributions of student responses to survey questions about digital communication tools and demographics were examined.

It was found that there is a high degree of correlation between frequency of teachers' use of digital communication tools and student's perception of their level of motivation. It was also found that the digital communication tools most frequently used by teachers in communicating with their students were email, the telephone, and assignment feedback, and that the students found these same tools the most helpful in their learning. In addition, no significant demographic differences were found in students' perception of teacher's use of tools to enhance learning and motivation in their courses except in the number of previous online courses taken. These findings can help direct online high school teachers in their selection of digital tools used to communicate with their students.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1: INTRODUCTION

In 1956, Benjamin Bloom (Bloom, 1956) and a group of the nation's top educators categorized learning into three areas; they labeled them the cognitive, psychomotor, and affective domains. These overlapping domains describe the knowledge, physical skills, and attitudes respectively, of a learner (Adkins, 2004). When thinking about education, we often focus on the cognitive domain, but masterful teachers know the old adage attributed to Theodore Roosevelt that "nobody cares how much you know until they know how much you care". Masterful teachers take advantage of this wisdom by reaching out to students in the affective domain to help increase student performance by building improved student attitudes toward learning (Anderson & Hounsell, 2007).

Much research has been done in finding how learners' perceived self-efficacy affects their attitude and ability to learn. Bandura (1994) stated, "Self-efficacy beliefs determine how people feel, think, motivate themselves, and behave" (p. 71). According to Bandura's Social Cognitive Theory (1986), self-efficacy beliefs produce effects through the processes of cognition, affection, motivation, and selection.

Self-efficacy on the part of the learner is just as important, possibly more, in an online environment as in a traditional classroom due to lack of face to face contact (Dziuban, Moskal, & Dziuban, 2000). Gunter, Gunter, and Wiens (1998) state, "Faculty must understand that one of the strongest impacts on the educational process is that students' attitudes affect their process of learning"(p. 1). Lee and Witta (2001) show that both self-efficacy regarding course content, and self-efficacy regarding students' ability

to succeed in an online course change over the duration of the time that the student is in the course. This indicates that it is important for teachers to build on any of the positive self-efficacy beliefs a student may have.

Since the ways of addressing students' perceived self-efficacy are different in the traditional classroom than when teachers are not in the same physical location as their students, studies conducted in a traditional setting are not generalizable to the online learning environment (Perez-Prad & Thirunarayanan, 2002; Poirier & Feldman, 2004). Poirier and Feldman (2004) found that there was a statistically significant main effect in exam performance due to course format. The Perez-Prad and Thirunarayanan (2002) study compared students who took a course online to a second group that took the same course in a traditional setting and concluded that lessons which were directed mainly at students' affective domain were not perceived in the same way by online students as those in the traditional classroom setting. Since online learning is rapidly becoming an important component of the way we deliver content in today's society, research to find the most effective ways for online teachers to communicate with students is a critical need (Bushweller, 2002; Pascopella, 2003; Poirier & Feldman, 2004).

Teachers cannot expect to be successful at teaching students without regard to whether or not the student will be receptive to learning the material that is being presented. Lee and Witta (2001) state that due to the known attrition rate for online courses, understanding students' motivation and being able to foster that motivation is crucial for educators. Mullen and Tallent-Runnels (2006) reiterate that motivation is critical in an online environment because students have little face-to-face interaction and are often working alone.

During the past decade, the use of the Internet and World Wide Web (WWW) for course delivery has been utilized by numerous colleges and universities. The idea of delivering courses over the Internet to high school students was therefore a natural extension and has already been implemented in over half the states in the country (Borja, 2005; Watson, 2005). Thus, it is useful to expand the research base concerning how teachers teach students and at the same time help develop or maintain good student attitudes about online learning both at the college and high school levels.

Coppola, Hiltz, and Rotter (2002) conducted a study with teachers who taught online courses and explored how students enrolled in these classes were motivated to learn. Faculty members felt that they had a more limited range of tools to express emotions, yet they felt that they achieved a higher level of intimacy and connection with students online than in a traditional classroom. This information underscores the need for more research to explore how connections with students are made by instructors and which communication tools best serve to improve attitudes, self-efficacy, motivation and consequently student performance.

Spencer (2001) found that computer-mediated communication creates numerous benefits for students. These include more communication between students, more thoughtful communication, and more satisfaction on the part of the learners. Spencer (2001) also noted that students in an online course were better able to work at the higher levels of learning such as analysis and synthesis. With digital communication tools, the entire class can analyze a question and respond as compared to a traditional classroom where often only a few of the students respond to a question. More thoughtful

consideration is given to the communication done when it is computer-mediated (Spencer, 2001).

A body of research already exists that compares online learning to traditional classes. These studies have shown that in many ways online learning can be as good as, or better than, the learning that students do in a traditional classroom setting (Bushweller, 2002; del Corral, Guevara, Luquin, Peña & Otero, 2006; Goff-Kfouri, 2006; Pape, 2006; Smith, Ferguson, & Caris, 2001; Spencer, 2001; Yang & Liu, 2007). Spencer (2001) found that online students felt communication was more satisfying, the class was more interesting, there were a greater number of higher order learning outcomes, and more collaboration between students as compared to those students enrolled in the same type of class but taught in a face-to-face format. These findings reveal that students felt communication in the online class was more interactive and motivating. Yang and Liu (2007) state advantages such as overcoming barriers of time and space and interactivity but also list disadvantages related to human interaction available in face-to-face conversation. Yang and Liu (2007) then go on to discuss how technology is being used to overcome the few remaining disadvantages through streaming media. Pape (2006) discussed ways that traditional schools are beginning to make use of online advantages through blended learning; classes that meet in the traditional way but also have online components. Blended learning has the advantages of retaining the benefits of face-to-face synchronous interaction while also taking advantage of the flexibility of asynchronous online learning (Dziuban, Hartman, Moskal, & Sorg, 2006). Offerman and Tassava (2006) give a perspective that face-to-face time is not necessary for pedagogical reasons but it is valuable for social reasons. This concept fits with the ideas that student attitudes

are essential ingredients in the learning process (Gunter et al., 1998). Dziuban et al. (2006) see blended learning as focusing what institutions have learned in their initial online offerings to distance learners toward the on-campus students as well as faculty.

Currently, teachers who teach online report that they are able to build a close relationship with their students that is sometimes more in depth than those relationships built when teaching in a traditional classroom and that they are able to reach all of the students and build relationships (Contreras-Castillo, 2006; Pérez-Fragoso, & Favela, 2006; Coppola et al., 2002; I. Payne, personal communication September 27, 2006; Spencer, 2001; September 27, 2006; M. Vangalis, personal communication, September 27, 2006). Finding out more information about how these relationships are built and maintained was the goal of this research. A survey of students' perceptions about their attitudes and how these were affected by digital communication tools while taking an online course was conducted. This research examined which of the following tools were perceived by students to be useful or not useful in the communication process: email, instant messaging (IM), chat, telephone, discussion area, whiteboard, and assignment feedback.

Research Questions

1. What is the relationship between student motivation and teacher interaction for sixth through twelfth grade students in an online setting?
2. To what degree do students perceive that their teachers use the digital communication tools?

3. Which of the digital communication tools do students perceive to be most helpful?
4. What is the relationship between student learning and student demographics for sixth through twelfth grade students enrolled in online classes?

Definitions of Terms

For purposes of this study, the following definitions will be used:

1. Assignment feedback – a part of the course delivery software that allows the teacher to make comments about student work which has been submitted. These comments may include remarks about the quality of student work, explanation of the grade given for the work, suggestions for improvement in future submissions of the work, and messages of encouragement to the student.
2. Chat – Synchronous messaging conducted either through the course management software or some other software such as Elluminate. This is normally in the form of written text, but may also include emoticons. Chat is synchronous communication of two or more students and or teachers within a designated window.
3. Digital communication tools - email, IM, chat, telephone, discussion area, whiteboard, and assignment feedback.
4. Discussion area – a part of the course delivery software that allows teachers and students to post a message that can be read and responded to by others in the course as well as the instructor in an asynchronous fashion.

5. Email – correspondence between teacher and students delivered to either the student's course mail area or to some other email address.
6. Instant messaging (IM) – A brief message from one person to another that may receive a brief response.
7. Motivation – A student's incentive to perform those tasks which are included in their online course for the purpose of promoting student learning. For purposes of this research study a motivation score was calculated for each respondent by averaging student Likert scale responses to questions from an instrument designed to determine levels of motivation.
8. Perceived self-efficacy – Bandura (1994, p71.) states "Perceived self-efficacy is defined as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives."
9. Student learning – progress toward course objectives made by students as determined by the students' perception of their teacher's use of digital communication tools and by the student's motivation scores on the survey instrument used for this research.
10. Teacher interaction – what occurs when teachers provide instructional support and feedback to students using various communication tools..
11. Telephone communication – use of the telephone by teachers and students to communicate about the course in which the student is currently engaged.
12. Whiteboard – a part of the course delivery software that allows teachers and students to type, draw, use symbols, and share Web page information and files that can be viewed synchronously by the teacher as well as one or more students.

Limitations of the Study

This study contains the following limitations:

1. The participants voluntarily answered the questionnaire. This is a limitation because many students who had the opportunity did not take the survey. Since the students who did take the survey were self-selected there can be no assumption of randomness for the sample of the population.
2. The online survey capabilities of FLVS's database system allowed for ease of survey delivery to large numbers of students but did not allow tracking of students who respond to the survey. The students chosen for the sample were close to finishing (at least 70% of the course work for the individual course they were taking at the time) or who had recently finished a course with FLVS by the spring semester of 2006. Students who fit the parameters of course completion numbered 6,988 and all of these were given an opportunity to participate in the study.
3. The researcher was a member of the organization being studied. This may influence views and opinions that the researcher had about the organization. Being familiar with the organization did give the researcher the advantage of insights and knowledge that would not be available to someone from outside because of the tens of thousands of hours the researcher was involved with the students, teachers, and administrators of FLVS.

Delimitation of the Study

The survey for the study was given to students who were taking or had taken a course from the Florida Virtual School (FLVS) during of the spring semester 2006. Thus

the results are only generalizable to students at FLVS or other education entities similar to FLVS who have similar demographic characteristics to those students who participated in the study.

Assumptions of the Study

The assumptions made for this study are as follows:

1. The participants responded honestly to the questions asked.
2. The responses given by the students reflect what they actually believe about the course they took.

Significance of the Study

This study is significant to the field of the study of online learning because the information provided will guide teachers and let them know which of the selected communication tools are perceived by students to be effective in allowing teachers to increase motivation and self-efficacy of their students and which tools are perceived to be significantly more effective than the other tools. Teachers in traditional classrooms have the ability to use facial expressions such as a smile, tone of voice, and instant feedback to bring about a change in students' attitudes toward their learning. Online teachers do not have the same tools to communicate with and often feel limited because of this (Price, Richardson, & Jelfs, 2007). Some students who do not respond well in the traditional classroom are able to flourish in a more anonymous setting (Pascopella, 2003; Price et al., 2007). Since technology has proven to be popular among today's digital native students, it is important to know which digital communication tools are perceived to be

effective and what is currently being practiced that improves students' motivation resulting in a higher level of self-efficacy and ultimately enhanced performance in an online environment.

First the relationship between student motivation and teacher interaction has been explored. This will help teachers understand the effect of interacting with their students using digital communication tools. Second the students' perceptions about their teachers' use of the digital communication tools of email, IM, chat, telephone, discussion area, whiteboard, and assignment feedback were studied. Third the students' perceptions about the helpfulness of the digital communication tools were recorded. These tools are widely available and can currently be used by teachers and students so knowing student preferences and attitudes toward these tools can inform the practice of teachers who teach online. Fourth, the relationships between student learning and demographics were explored to assist future teachers with more detailed knowledge of how to work with different types of students.

CHAPTER 2: REVIEW OF THE LITERATURE

The Beginnings of Distance Learning

Distance learning in various forms has been with us for over a century (Silverman, 2001; Zucker & Kozma, 2003). Before the Internet and World Wide Web, distance learning was often referred to as correspondence courses. Printed materials were delivered to students and then assignments were mailed to instructors, corrected and returned through the mail (Silverman, 2001; Zucker & Kozma, 2003). As early as 1906 the Calvert School in Baltimore, Maryland began producing home instruction materials and by 1909 these were being used in by students in 40 states and 10 foreign countries (Wooster et al., 2001).

Broadcast radio and television were used as these technologies became available, then the advent of video cassette recorders (VCR) added new capabilities in presenting material (Prewitt, 1998). Setzer and Lewis (2005) state that 16% of United States school districts who have students enrolled in distance learning courses still use VCR technology, while 55% of the districts which offer distance learning use two-way interactive video and 68% use the Internet.

Prewitt (1998) explains that the early efforts at distance learning were designed to simulate the traditional classroom but once computer mediated distance learning became available curriculum designers were able to take advantage of technological capabilities and fundamentally change the curriculum as well as the relationship between the learner and the instructor. Soon after computer mediated technology began to be used it was realized that multiple learning styles could be accommodated by allowing students to

choose from a list of activities that target each learning style (Prewitt, 1998). In addition, students are able to work collaboratively and share ideas electronically in ways that cannot be achieved in a traditional classroom (Prewitt, 1998). An asynchronous online discussion can allow students to spend time carefully thinking about their contribution to a discussion and be able to incorporate higher levels of thinking skills such as analysis, syntheses, and evaluation in their discussion postings than can be achieved in a real-time discussion (Hines & Pearl, 2004; Johnson, 2006). Thus, within the first decade of Internet availability, distance learning had reached a point where it could promote a better understanding of course content (Prewitt, 1998).

Cavanaugh, Gillan, Kromrey, Hess, and Blomeyer (2004) in a meta-analysis of K-12 distance learning studies found several studies that documented improved student achievement for online learners over their traditional classroom counterparts. Some of the studies in the meta-analysis contrastingly showed no significant difference in academic achievement between online learners and traditional students (Cavanaugh et al., 2004). Cavanaugh et al. (2004) found only a few studies that reported higher levels of academic achievement in face-to-face classrooms than in the equivalent online delivered course that was studied. Shieh (2006) sums up the findings on distance learning by noting that computer mediated communication has the potential to create what cannot be achieved in a traditional classroom.

Wiens and Gunter (1998) reported that common problems with early Web-based courses were caused by not keeping a balance between curriculum, pedagogy, and technology. Some early Web-based courses focused on one of these crucial elements to the detriment of the others (Wiens & Gunter, 1998). Wiens and Gunter (1998) described

three stages of Web-based instruction which will help educators keep the crucial balance between curriculum, pedagogy, and technology. They are the design stage where the instructor plans how the curriculum and pedagogy can best take advantage of an online environment, the development stage where a technical support team works with the instructor to code the Web pages and set up any other technology that will be used, and the delivery stage where the course is offered to students and the instructor works to support their learning (Wiens & Gunter, 1998). During this delivery stage the instructor is able to work with students' attitudes and affections through the various available digital communication tools which are always evolving but commonly include email, instant messaging (IM), chat, telephone, discussion area, whiteboard, and assignment feedback (Absalom & Marden, 2004; Beldarrain, 2006; Bigbie & McCarroll, 2002; Cavanagh, 2006 Contreras-Castillo et al., 2006; Goff-Kfouri, 2006; Hines & Pearl, 2004; Hrastinski, 2006; Shelton, 2000; Tello, 2002).

Today's online students, referred to as Millennials or the Digital Generation have high expectations because of their digital literacy and previous experience with communication tools delivered via the Web (Skiba & Barton, 2006). Three things the Millennials are accustomed to in everyday activities and expect in their learning are interactivity, immediacy, and experiential learning (Skiba & Barton, 2006). Brown (2005) states that current technologies allow students to access information and communicate with one another at any time and from any place. This allows Millennials to work from virtual learning spaces as well as traditional physical classroom spaces (Brown, 2005).

Dziuban et al, (2000) found that students with certain learning styles preferred to use online courses more than those with other learning styles. Using the Long Theory of Reactive Behavior, Dziuban, et al. (2000) found that aggressive (energetic) dependent (seekers of social acceptance) learners prefer online courses at about the same rate as did aggressive independent learners with 72% and 74% respectively of these students rating online courses as better than traditionally delivered courses. For passive learning style students, the variation between independent and dependent students' ratings was more dramatic with 87% of the passive independent students preferring online course delivery and only 68% of passive dependent students preferring the online mode (Dzuiban, et al., 2000).

Today's students have been referred to as digital natives because they have always been acquainted with Internet based technologies (Prensky, 2001). Due to the volume of student use of computers, video games and television, digital natives process information differently than their predecessors and digital tools are used as an extension of their brains (Prensky, 2005). Stewart, Ezell, DeMartino, Rifai, & Gatterson (2006) found that today's students have made video games and the virtual environment part of their educational environment and may learn little in traditional educational settings. Gee (2006) theorizes that video games allow a person to become part of a virtual world then solve problems to achieve goals which replicates the same thinking that individuals do in the real world when successfully solving problems. This makes video games ideal practice for problem solving thinking skills (Gee). Thus the challenge for today's distance learning teachers and future online learning providers is to meet the high

expectations of these referred to as Millennials, Net Gen students, or digital natives (Brown, 2005; Skiba & Barton, 2006).

Current Trends in Online Course Delivery

The Internet and World Wide Web have only been widely available for K-12 school use for a little over a decade (Barker & Hall, 1998; Bauck, 2001; Ely, 2002). In this short period of time rapid changes in course delivery technology have occurred but methods and techniques of successfully teaching online are still evolving (Congleton, 2006; Ely, 2002). These facts substantiate the idea that even though many studies have already been conducted in this area there is still much research to be done (Barrett & Lally, 1999; Colley, & Comber, 2003; McCoy & Heafner, 2004; Ryan, 1996; Perez-Prad & Thirunarayanan, 2003, Picciano & Seaman, 2007). Several advantages for the addition of online courses to a school district's offerings were discovered in the first few years of Internet availability. They include the facts that students that attend schools which are otherwise unable to offer higher-level courses can access a much wider range of curriculum choices and the fact that students can accelerate their learning (Mather, 1998; Shelton, 2000; Zucker & Kozma, 2003). In addition, online courses allow students to work at their own speed, to have possible access to better courses and better teachers, and eliminate the need for students having to wait for others in the class to grasp the material before progressing (Mather, Shelton, Zucker & Kozma). With the inclusion of online courses, students no longer need to confine their learning to normal school hours and days, they can more easily repeat courses they failed and there are more ways for

scheduling conflicts to be resolved, as well as the fact that 21st century skills become a part of students' normal school activities (Mather, Shelton, Zucker & Kozma).

The Sloan report on K-12 online learning (Picciano & Seaman, 2006, p. 9) found that school district officials rated the importance of reasons for offering an online course in the following order:

1. Offering courses not otherwise available to the student
2. Meeting the needs of specific groups of students
3. Offering Advanced Placement or college-level courses
4. Reducing scheduling conflicts for students
5. Permitting students who failed a course to take it again
6. Certified teachers are not available for traditional face-to-face instruction
7. Addressing growing populations and limited space
8. Online and blended offerings are financially beneficial
9. Online and blended offerings are pedagogically more beneficial
10. Students prefer online course activities.

As schools look into whether or not to invest in online learning, studies have emerged comparing online learning and the traditional learning environment. One early Canadian study showed no significant difference in outcomes between students who took an advanced mathematics course using audio teleconferencing verses those who took the same course in a traditional classroom setting based on the final grades of students in the course (Ryan, 1996). This was followed by a host of other studies which were designed to compare the traditional classroom with online learning and have well established the view that students can learn as much from a course delivered online as they do in a traditional classroom setting (Bushweller, 2002; Cavanaugh et al. 2004: del Corral et al., 2006; Goff-Kfouri, 2006; Pape, 2006; Smith et al., 2001; Spencer, 2001; Yang & Liu, 2007). Bernard et al. (2004) in a meta-analysis of distance education research covering 232 studies found that although the quality of research in distance education is low with

generally low internal validity of the studies, there is a general agreement among the studies and evidence to support the conclusion that classroom instruction and distance education are comparable. Bernard's et al. (2004) findings emphasize the need for continued research and a reliable and valid way to help discover how best to conduct online learning. Sheih (2006) states that online teachers need a different set of competencies than those teachers that teach in traditional classrooms. Beldarrain (2006) gives us a view to the future that emerging technologies can even influence learning theory. Sharon Johnston of the Florida Virtual School stated that "Virtual educators are reshaping the routine learning modes of the traditional school day to a dynamic, interactive, real-world learning environment that presents choices to parents and students and requires students to take ownership of the learning process" (Johnston, 2004, p.133). One could conclude from these statements that continuous research in the area of digital communication tools is inevitable. Recent literature contains speculations about possible future benefits of the newest technological tools as they become integrated into education (Beldarrain, 2006). The time it takes for quality research to be completed on the use of a new technology delays our knowledge of exactly how beneficial it may be to students (Beldarrain, 2006; Bernard et al., 2004).

Much concern in early literature had been expressed regarding females' use of technologies as compared to males' due to early studies such as Barrett and Lally (1999). For example, a study conducted by Barrett and Lally in 1999 showed that there were significant differences between men and women in their attitudes towards computer mediated communication while taking a distance education course. This study, however, was conducted with students who began their learning without using computers, rather

than students who have always had access to computers, the digital natives that we have today. More recent studies appear to support the notion that there may no longer be the same gender differences in the affective domain that Barrett and Lally found only a few years ago (Colley, & Comber, 2003; Enoch & Soker, 2006; McCoy & Heafner, 2004, Shin, 2006). Enoch and Soker (2006) state that differences in computer access in age and ethnicity as well as gender are evaporating. Enoch and Soker noted however, that the closing of the gender gap has not occurred in Israel as rapidly it has in the U.S. so gender differences should still be considered as a possibility for most research in the field. Although gender differences in online learning at the K-12 level are generally no longer a concern, one predicted future educational tool, online gaming, is still an area where strong gender differences exist (Hayes, 2005; Pascopella, 2006). Hayes (2005) suggests, however, that the act of game playing itself may involve creation of virtual identities that will be reflected in changes to a person's real world identities. As educators explore ways to incorporate gaming into learning experiences, gender differences need to be considered but may also be found to be fluid as students progress through game related learning (Hayes, 2005).

Ely (2002) discusses the fact that current trends in distance learning are difficult to track accurately due to the constantly emerging technologies and practices in this area of education. One powerful trend driven by the confluence of the widespread use of personal computers, the Internet, and the World Wide Web, and the ease of accessing information with these tools is the online delivery of instruction (Ely, 2002). Streaming video is now widely used to enhance online courses (Ely, 2002). Therefore, we have a constant need to update research in order to evaluate changes that are rapidly occurring

due to technology improvements. The November 2006 Sloan report on K-12 online learning confirms that research in the field is lacking citing that the U. S. Department of Education's most recent report includes data from the 2002-03 school year (Picciano & Seaman, 2006). Picciano and Seaman reported that as of 2006, 58% of school districts had at least one student taking an online course while 10% plan to offer online courses within the next three years. It was also found by Picciano and Seaman that the most commonly used providers of online courses are post-secondary institutions (47% use this as one of their sources), state virtual schools (34% use this as a source), other schools or districts in the same state (22% use this as a source), and self-produced courses within the district using the course (20% use this as one of their sources). Seventy-four percent of the districts use multiple sources for online course delivery.

The Sloan report findings show that K-12 online learning has increased tenfold between 2001 and 2006 and that this growth is expected to be sustained due to common acceptance of technology, the desire of districts to offer a larger variety of courses to students, and governmental policy changes (Picciano & Seaman, 2006).

Virtual High Schools

Before the start of the 21st Century the states of Florida, Hawaii, Kentucky, Louisiana, New Mexico, and Utah already had online virtual schools in place and many more states were in the process of developing online programs for students (Trotter, 2000). In addition to these state-wide initiatives, many districts, individual schools and universities had already started or were developing online learning opportunities for high school students (Carr, 1999; Trotter, 2000). Cavanaugh (2001) performed a meta-analysis

of distance education involving 19 studies. Thirteen of the studies used two-way audio-visual conferencing, five of the studies used email and only one used the Web. An illustration of the complete revolution of distance education delivery is that just five years later another meta-analysis of 14 studies was done by the same author with Web based course delivery being the only delivery method that was used in any of the studies (Cavanaugh, 2004). For the 2005-2006 school year it has been estimated that over 700,000 K-12 students were involved in an online course with an estimate of 850,000 for the 2007-2008 school year (Picciano & Seaman, 2007). The rapidity of the growth as well as the numbers of students involved illustrates that online learning at the high school level will become an integral portion of the way students receive at least part of their high school education (Greenway & Vanourek, 2006).

In many ways traditional learning and online distance learning contain the same elements of teaching, curriculum, grading, and parent conferences according to Greenway and Vanourek (2006). One key difference between the two types of course delivery is that in traditional learning the time a student is in class is constant while the learning varies from student to student depending on a number of factors, but in online learning the lesson to be learned is fixed and students can vary the time they need to achieve mastery (FLVS Accreditation and History, 2007; Greenway & Vanourek, 2006; Johnston, 2004). Greenway and Vanourek (2006) stated that increased individualization and self-paced learning create an environment where some students who have not done well in traditional schooling thrive. The North American Council for Online Learning and the Partnership for 21st Century Skills (2006) stated that the online learning of virtual schools naturally creates an environment where 21st Century Skills such as online

collaboration and the effective use of technology are fostered as students work toward subject-matter mastery. The inherent strengths of virtual schools allow them to increase students' global awareness, self-directed learning, information and communications technology literacy, problem solving skills, time management skills, and personal responsibility (North American Council for Online Learning and the Partnership for 21st Century Skills, 2006).

Kachel et al.(2005) felt that the best approach for high school students to be introduced to online learning would be a hybrid course where some face-to-face time with the teacher is incorporated with the online learning component of the course. Writers discussing blended learning at the high school level are often referring to the student taking most of their credits in a traditional fashion while taking one or two completely online courses rather than teachers spending some face-to-face time with their students in a largely online course (Lake, 2006; Top Ten Myths About Virtual Schools, 2007). Literature written about higher education online learning normally refers to blended learning as being a single course where some face-to-face time is spent (Dziuban et al., 2006). Allen, Seaman, and Garrett (2007) define blended learning in higher education as a course where 30 to 80 percent of the course material is delivered online. The 2006 Sloan report on K-12 online learning (Picciano & Seaman, 2006) also uses the 80 percent online delivery cut off as a determination of an online course but mentions the fact that generally accepted definitions have yet to be established. An awareness of the vocabulary differences used by writers regarding K-12 education as compared to higher education can assist researchers in their comprehension of the different meanings current authors have while using the term blended learning. Julie Young, President and CEO of the

Florida Virtual School predicts that within five years we will see blended models for high school students (Lake, 2006). The students may attend school on certain days then work from home on other days or students may take some courses in a traditional school and others online which is commonly done by most Florida Virtual School students now (Lake).

The Florida Virtual School

Florida Virtual School (FLVS) was one of the early virtual high schools in the nation and along with the Virtual High School has had a major influence in the recognition of K-12 online learning (Greenway & Vanourek, 2006). Florida Virtual School started in 1997 as a cooperative effort involving the Alachua County and Orange County school districts and was originally funded by the state legislature (Clark, 2001). The original funding was a Break the Mold School grant from the Florida Department of Education for $200,000 (Bigbie & McCarroll, 2000). Funding for the next two years was from the Florida Legislature for $1.3 million and $4.3 million dollars (Bigbie & McCarroll, 2000). In 2000 the Florida legislature designated FLVS as a separate school district serving the entire state with a board appointed by the governor (Bigbie & McCarroll, 2000). Funding is now based on the number of students who complete a course as part of the state legislature's public school funding program (FLVS Accreditation and History, 2007).

Florida Virtual School began with 77 enrollments the first year, 2900 in 1997-98, 7000 in 1998-99 and had grown to serve over 31,000 students completing 68,000 half credit courses by the 2005 -2006 school year (FLVS Accreditation and History, 2007).

All of the 300 plus full time teachers and 180 adjunct teachers are fully certified by the State of Florida to teach in their subject area and over 75 of the FLVS teachers hold National Board Certification (FLVS Facts, 2007). Nearly two-thirds of the teachers hold advanced degrees beyond a Bachelor's degree (FLVS Facts, 2007). FLVS offers more than 90 courses and is accredited by the Southern Association of Colleges and Schools. Awards include:

1. 2006 *EdNET* Impact Award
2. 2005 USDLA 21st Century Best Practices Award
3. 2004 Excellence in IT Leadership from IT Florida
4. 2003 *Business Week* named FLVS as one of the WebSmart Top 50 organizations
5. 2003 USDLA Excellence in Distance Learning
6. 2002 USDLA Excellence in Distance Learning
7. 2002 Global Alliance for Transnational Education (GATE) "Medallion of the Alliance"
8. 2000 Canadian Association Distance Education
9. 2000 USDLA Excellence in Distance Learning
10. 1999 SouthEast Initiatives Reg. Tech. in Ed. Consortium SEIR/TEC (FLVS Facts, 2007, ¶6).

Florida Virtual School students attend public schools (72%), home schools (21%) and private schools (7%) (FLVS School Data, 2007). Most students take one or two courses with FLVS and the remainder of their courses in a traditional school setting

(Zucker & Kozma, 2003). Students from all districts of the state are enrolled with 60% female and 40% male (FLVS School Data, 2007).

The main mode of course delivery for FLVS is asynchronous and was designed using the Internet so that students can access their courses according to the "any time, any place, any path, any pace" philosophy of the school (Bigbie & McCarroll, 2000). The teachers and students also used the digital communication tools including email, the telephone, discussion area, Instant Messaging (IM), chat, and assignment feedback from the earliest years of the schools' development (Bigbie & McCarroll, 2002).

Learning Theory as It Relates to Online Courses

Current state standards in place for high school courses include provisions that require higher taxonomic levels of learning so it is important to understand how analysis, synthesis, and evaluation occur. Laurillard (2002) matches technologies with learning events through the use of a tool she describes as a "Conversational Framework." The framework includes:

1. how the teacher and student conceptions are formed through a reiterated process of sharing ideas;
2. how the student conception is related to his or her actions through adaptation and reflection;
3. how the student actions and teacher constructed environment interact through goal setting, action, feedback and modified action;
4. and how the teacher conception and constructed environment are related through adaptation and reflection (Laurillard, 2002).

Laurillard (2002) states that student's attitudes and beliefs affect the processes of sharing ideas, what actions they would take, and how he or she would set and strive to achieve goals and are therefore, critical to the learning process. Bird (2007) expands Laurillards's conversational framework to include not only teacher-to-student interaction but student-to-student interaction as well. Bird states that shared knowledge is constructed between learners as the content of a course is discussed between students as well as between the teacher and student.

When working with students in an online environment, educators can easily post information designed to deliver facts on a Web site. In order to be successful in getting students to learn, teachers must take into consideration the affective domain which has been shown to influence student learning (Smith et al., 2001; Wiens & Gunter, 1998). Smith et al. (2001) stated that electronic communication tools often allow the teacher to connect directly with individual students and can be useful in positively affecting students' attitudes. Bandura (1986) relates affection and motivation to self-efficacy noting that both affection and motivation are crucial factors in building self-efficacy. Thus the level of affection, motivation, and in turn, self-efficacy influences student performance (Bandura, 1986; Peng, Tsai, & Wu, 2006; Wadsworth, Husman, Duggan, & Pennington, 2007).

Hammerback (2002) stated that professors can best support their students by getting them to take a personal interest in the teacher and the course content and encouraging them to go beyond just memorizing facts to extend knowledge into higher levels of learning. Finding those techniques that may be significantly more effective than

the others in getting students to identify with the instructor in online learning is an important component of this research project.

Several studies report that student-teacher interaction affected student learning significantly (Kim & Bonk, 2006; Pan 2003; Spencer, 2001; Swan, 2002). Swan (2002) proposed that the quality of the interaction was more important than the quantity, but also stated that further research was needed in this area. In addition, Swan (2002) stated that three factors are important in online learning. They are interaction with content, the instructor, and other students. Further information about the interaction with the instructor was the focus of the research done in this study.

Numerous researchers have stated that participating in distance learning in many cases increases individualization and that the interaction between learner and instructor is when the instructor has the opportunity to shape students' attitudes and beliefs and help students enhance their own self-efficacy and motivation in a way that will increase learning (Kim & Bonk, 2006; Johnston 2004; Pengitore, 2005; Silverman, 2001; Smith et al. 2001; Tello, 2002). Bandura (1986) theorized that the processes of the affective domain and motivation improve self-efficacy, which in turn increases student achievement. Because of their high level of use in existing online courses at FLVS the digital communication tools that were selected for this study allow teachers to effectively address these processes. Smith et al. (2001) suggests that motivation be accomplished by distance instructors through the use of three types of interactivity:

1. learner to content interaction,
2. learner to learner interaction,
3. learner to instructor interaction.

The focus of this study was on the learner to instructor interaction but the digital communication tools studied facilitate all of three of these interactions. Johnston (2004) states that the FLVS instructors view the communication facilitated by these digital communication tools to be the key ingredient in the success of their students. Tello (2002) suggests a triad of actions that are important in modifying student attitudes toward interaction with the instructor: timely responses, frequency of interaction, and appropriate assignment feedback. Hopefully the results of this study will be valuable to assist instructors in selecting the proper digital communication tools by identifying which ones students perceive to provide more effective interaction during the course. Some researchers believe that correct strategies in selecting the proper communication tool are crucial to student success (Freeman, 2003, Kim & Bonk, 2006).

Piaget's and Vygotsky's theoretical work have led modern educators towards constructivism in the design of curriculum (Sheih, 2006). Piaget's preoperational, concrete operational, and formal operational stages offer guidance for developing online courses appropriate to young learners (Cavanaugh et al., 2004), Cavanaugh (2004) states that online students in the concrete operational stage need to use simulations and multimedia manipulations while those in the formal operational stage can use symbols and language to think more abstractly. Vygotsky expanded on Piaget's concepts to theorize that students learn when they are in their zone of proximal development where tasks cannot be accomplished alone but can be completed with assistance (Cavanaugh et al., 2004). One conclusion that may be drawn from these theories is that the digital communication tools that teachers and students use are an essential part of online learning.

Of the seven digital communication tools studied, only assignment feedback is mainly used for one-on-one communication between the teacher and student. All of the others facilitate communication between teacher and student or groups. Since collaboration is an important part of the construction of knowledge and constructivism is widely used to drive curriculum design in modern online learning these tools fit today's educators' paradigm of how distance education should be conducted by helping to foster a community of learners (Johnston, 2004, Shieh, 2006).

Of the seven tools studied, four, email, discussion area, whiteboard, and assignment feedback, facilitate asynchronous communication. The other three (IM, chat, and the telephone) facilitate synchronous communication. Communication in real time (synchronous) or at any time, any place (asynchronous), each have their advantages. The advantages attributed to asynchronous computer mediated communication include time for reflection, a level playing field between different personality types due to anonymity, the fact that the act of writing itself enhances higher level thinking skills, and the ability to work and learn at any time and any place (Shieh, 2006). Email and threaded discussions are among the most common ways for online instructors to conduct asynchronous discussions (Beldarrain, 2006).

Advantages of synchronous computer mediated communication include the fact that ideas are exchanged more quickly and the ability to collaborate in real time (Shieh, 2006). Chat areas and whiteboards work well for synchronous small group discussions but don't allow for full student-student collaboration (Beldarrain, 2006).

Synchronous communication tools can allow students to provide and receive instant feedback, share knowledge and clarify misunderstandings (Beldarrain, 2006).

Synchronous interaction fits well with the constructs of social cognitive theory that support the concept that human functioning is the product of interpersonal interaction as well as behavioral and environmental determinants (Bandura, 1986). Bandura states that consciousness includes "…a conceptual functional component operating mainly through the linguistic medium" indicating that the communication between students and teachers or other students is part of the learning process. Beldarrain (2006) also states that synchronous collaboration will help prepare today's students to become part of a community of practice in their field of expertise tomorrow.

Yukselturk and Top (2006) suggest that the complementary strengths of asynchronous and synchronous computer mediated communication tools can enhance the efficiency and effectiveness of a quality learning environment. Bandura (2006, p.167) shows that students need interaction because the human mind is not just reactive but "… generative, creative, proactive and reflective". This interaction affects motivation which is one of the processes that bring about the effects of self-efficacy (Bandura, 1986). Motivation is critical in an online environment because students have little face-to-face interaction and are often working alone (Mullen & Tallent-Runnels, 2006). Spencer (2001) found that online students felt communication was more satisfying, the class was more interesting, there were a greater number of higher order learning outcomes, and more collaboration between students as compared to those students enrolled in the same type of class but taught in a face-to-face format.

Research Involving Digital Communication Tools

The use of computer mediated communication is fomenting rapid changes in practice in the field of online learning (Shieh, 2006). The digital communication tools used in this study include email, instant messaging (IM), chat, telephone, discussion area, whiteboard, and assignment feedback. All of these digital communication tools fit within the realm of computer mediated communication including much of today's phone usage due to Voice over Internet Protocol (VoIP) and cell phones. These tools are widely used in online K-12 education including at the Florida Virtual School, a nation-wide leader in online K-12 learning (Cavanagh, 2006). Beldarrain (2006) states that appropriate choices of technology tools need to be informed by research to determine how the ways that a student perceives their role in a group are affected by the digital communication tools that are available. Social presence is a factor in classroom teaching which is needed to improve affective learning (Shieh, 2006). Shieh states that social presence depends on two factors: intimacy and immediacy. Immediacy, or the perception of psychological distance between two communicants, can be fostered through participation in the learning activities (Shieh). Thus, it is imperative that online teachers are able to use pedagogical strategies that allow students to construct knowledge through collaboration. The digital communication tools used in this study are designed to facilitate this function of teaching.

Vast amounts of research on various aspects of online-learning, distance education, and computer-mediated communication exist but little is said about comparison of the actual digital communication tools available to students (Cavanaugh et al., 2004, Spencer, 2001, Shieh, 2006, Yang & Liu, 2007). Researchers attribute this to the fast pace at which changes are being made that allow more students to access the

Internet and World Wide Web in more locations and the time lag between when a product becomes available and when it becomes widely used enough to generate researchable data (Cavanaugh et al., Spencer, Shieh, Yang & Liu). Cavanaugh et al. noted the reason for a small body of research for K-12 online students being due to rapid changes in technology and implementation. The following sections describe how each of the digital communication tools studied here is typically used in an online class. This information would be useful for teachers in attempting to increase their students learning by improving motivation and self efficacy but few comparisons between the tools were found in the literature reviewed here. An exception is Temple, Kemp, and Benson (2006) whose comparisons of students' preference of the use of chat and the telephone in a college level nutrition course differed from those found in this study of students taking online high school courses.

Email

Email and threaded discussions are among the most common ways for online instructors to conduct asynchronous discussions (Beldarrain, 2006). West and Hanley (2006) state that interactions which are successfully conducted in a face-to-face environment do not necessarily transfer successfully to email. Thus educators need to be culturally sensitive and aware of the differences in these two types of communication (West & Hanley, 2006).

Although oral communication is more spontaneous, due to the temporal and physical separation of the communicating individuals in distance classes, email has been shown to reduce psychological barriers to learning caused by fear of expressing oneself

(Absalom & Marden, 2006). Absalom and Marden (2006) also state that motivation is increased due to anonymity, authentic communication, and the development of learner autonomy. Another distinct advantage of using email over oral communication is the written trail of the conversation that can be reviewed by each participant before additional replies are made (Absalom & Marden, 2006). Absalom and Marden (2006) identify the benefits of incorporating email with other learning activities as including increased motivation and participation rate, authentic communication, and the development of skills that transfer outside of the learning environment. Since email involves reading and writing it enhances student preparedness for the workforce in two of the areas considered as the most critical 21st century skills by employers (Assessment of 21st Century Skills, 2007; Casner-Lotto & Barrington, 2006).

Instant Messaging (IM)

Instant Messaging can be used to increase informal communication and add affective benefits which are as important in education as content learning (Contreras-Castillo et al., 2006). The use of IM in a course can add the spontaneity that does not exist with email (Absalom & Marden, 2006). Instant Messaging and chat can become unmanageable when large groups are involved due to the confusing number of messages being sent and received simultaneously (Contreras-Castillo et al., 2006). Contreras-Castillo et al. state that this tool is an excellent tool yet it needs to be confined to small groups or individual conversations.

Martin (2006) considers IM to be the language of today's students and feels that working with students in their own mode of communication helps build bridges to other,

more formal means of communication. Students who have interacted with their instructor online using this synchronous tool as well as communicated orally are more informed about their academic coursework (Martin). Martin states that the instructor's use of IM allows students to more efficiently get answers to short questions and course management specifics as well as questions about content, which in turn allows more time to be spent on academic pursuits. Studies that compare the introduction of IM to an existing course vary in their results. In one study comparing adult online learners with and without IM available found that some students used IM while others did not adopt the technology and that overall interaction among course members was not increased by IM (Hrastinski, 2006). In an instance of introducing IM into a high school environment, it was found that the students used the tool to socialize to such an extent that the faculty decided to stop using the software in the school (Texley, 2005). DeGennaro (2005), in an opposing view stated that the key to enhancing education through the use of IM is purpose and engagement rather than restrictive policy.

Haythornthwaite (2000) finds that three types of interactions are important for building and sustaining learning communities: information exchange, social support, and task support. Hrastinski (2007) found that groups who chose to incorporate IM for these purposes had a higher degree of participation than did those groups who relied solely on email to complete a two week group project. Hrastinski stated that active participation by students supports improved learning outcomes and retention rates.

Chat

Chat differs from IM mainly in the number of messages exchanged during one session and the number of individuals involved in the chat session (Absalom & Marden, 2006). Chat areas and whiteboards work well for synchronous small group discussions but do not allow for full student-student collaboration because of problems managing large groups in the chat area (Beldarrain, 2006; Texley & Adelstein, 2006). Chat and IM can bring a balance to the total overall communication picture by allowing for the benefits of synchronous discussion such as spontaneity and real-time answers to student questions to be added to the benefits realized from the use of asynchronous tools such as improved thought processes (Absalom & Marden, 2006; Hines & Pearl, 2004; Johnson, 2006; Martin, 2006). Another benefit of chat is the ability for a teacher to bring in an expert from a distant location to answer student questions and share information (Texley & Adelstein, 2006).

Pelowski, Frissell, Cabral, and Yu (2005) found that increased verbal immediacy by the instructor resulted in more positive affect regarding the course, greater perceived learning on the part of the student as well as improved course satisfaction. Pelowski et al. also found that the spontaneity of chat may be more motivational than asynchronous discussions. Thus the use of a chat tool in an online course can help build immediacy behaviors which positively impact learning (Pelowski et al.). Baker (2004) also investigated the effects of teacher immediacy behavior on affective and cognitive learning and found a positive correlation when verbal immediacy behaviors such as the use of humor and self-disclosing comments occur.

Saab, van Joolingen, and van Hout-Wolters (2006) focused on the relationship between collaboration through computer-mediated chat and discovery learning. Saab et al. (2006) found that the use of chat facilitated students' sharing of ideas as they constructed knowledge about experiments they performed by manipulating parameters in a given environment. Saab et al. (2006) also found that chat assisted students in the generation of hypotheses, design of experiments and construction of conclusions. Saab et al. (2006) found that only about 15% of students' conversation was off-task while using chat during a course. Lopez-Morteo and López (2007) found that although students may use a chat area for socialization while working on mathematical problems, the students were capable of maintaining focus on the math problems throughout the lab session.

Pan and Sullivan (2005) found that chat can be a problem if too many students are in one chat room simultaneously because it becomes difficult for the instructor to manage all of the questions and comments from students. Another disadvantage of the use of chat is insufficient time for student reflection (Pan & Sullivan, 2005).

Telephone

Although the telephone has been with us since 1897 it was not widely used for distance learning until the 1980's when improvements in teleconferencing technologies allowed instructors and groups of students to communicate synchronously from different locations without having to be concerned about extreme long distance charges (Brown, 2004). With today's rapidly improving telephone technologies including cellular networks, most students are now more available by phone than ever before (Henke, 2006). Henke (2006) states that according to a recent NetDay survey of 185,000 students

only 13% reported not having a cell phone which means that the phone is a viable tool for teachers to use to keep in touch with students and their parents. Olgren (1997) pointed out that effective use of the telephone in education depends on understanding the strengths and limitations of this tool. The strengths include two-way voice communication, accessibility and flexibility of local calls (Olgren). The limitations include lack of visual information available through the use of Web pages, and increased interpersonal distance when compared to face-to-face teaching (Olgren). Kachel, Henry, and Keller (2005) felt that the telephone is an excellent tool for students to get quick answers to questions about course material or logistics and teachers should be able to return calls within 24 hours.

Discussion Area

A great deal of research has been conducted in the area of the use of asynchronous discussion tools to enhance computer mediated communication in online courses (Beldarrain, 2006; Bird, 2007; Hines & Pearl, 2004; Johnson, 2006; Prewitt, 1998; Shieh, 2006; Wang & Woo, 2007; Yukselturk & Top, 2006). These researchers all agreed that the major benefit of the use of a discussion area is that it allows students to use higher level thinking skills in their responses because of the additional time to formulate a response and because of the written trail of communication which can be reviewed as a student formulates a response. Bernard's et al. (2004) meta-analysis of distance learning research is replete with examples of findings that agree with these benefits of a discussion area. Bird (2007) indicates that sharing and constructing of knowledge during discussion fits well within constructionist theory of how learning is achieved. Bird explains that dialogue and discussion are integral to all parts of the

learning process which he divides into content, construction and consolidation. Bird also states that a well designed discussion segment is essential to the social construction of knowledge in an online course. Wang and Woo (2007) identified additional advantages of online discussions including increased equality of opportunity for students who are shy, introverted, or have language difficulties.

One drawback found in several studies is the amount of instructor time needed to manage high-quality discussions which can easily generate thousands of posts from even a small-sized class (Bernard et al., 2004). Kachel et al. (2005) noted that another disadvantage of asynchronous communication such as a discussion board can be misunderstandings caused by the disjointed nature of the communication without opportunity for students and teachers to quickly check what was meant by a statement. Additional drawbacks of confusion on the part of students, and low quality discussion postings that do not contribute to the overall discussion were noted by Janssen, Erkens, & Kanselaar (2007).

Whiteboard

Whiteboard tools normally include the ability for students and teachers to type, mark, or draw on the whiteboard screen but are also normally bundled with application sharing, chat, voice and video for a complete range of synchronous computer mediated communication (Clark, 2005). Whiteboards and other real-time collaboration tools began to be developed in the 1990's in response to a need for students and instructors to be able to collaborate via the Internet (Swigger et al., 1999). Swigger et al. found that early users of collaborative tools were often confused and technologically inept whereas more recent

writers have found students now are easily able to collaborate using electronic tools (Hwang, Chen, & Hsu, 2006; Smith & Ferguson, 2004). Whiteboard tools are useful in mathematics courses because of the ability for students and teachers to collaborate as they write out the solution to problems (Hwang, et al., Stahl, 2006). Stahl reported that group cognition was facilitated using a whiteboard tool that also contained a chat area and the ability to connect one's comments to the whiteboard diagram with a line. This enabled other participants in the session to more clearly connect the drawing part of the discussion with the text from the chat area (Stahl). Smith and Ferguson (2004) state that many e-learning environments are more suited for language-based disciplines than for mathematics courses but whiteboard software allows for communication using math symbols and diagrams.

Whiteboard software has been included as an integral part of some learning management systems for a decade (Gore, 2000). Whiteboard capabilities have now become a standard part of most learning management software (Product Focus, 2006). As of 2007 33% of colleges and universities in the United States were using the Blackboard learning management system and 18% were using the WebCT learning management system both of which include whiteboard software as one of the tools that instructors can use with their online class (Falvo & Johnson, 2007).

Hwang et al. (2006) also states that math students in traditional classroom settings can benefit from the use of whiteboard software because it allows more students to display their work than a physical chalk or marker board and it allows information to be easily saved and recalled. Whiteboard presentations allow students to link graphics with words and improve learning since students are using images, as well as oral and verbal

communication to collaborate (Hwang et al., 2006). This is one example where digital communication tools developed to facilitate distance learning have migrated back to the traditional classroom because of their overall usefulness to promote collaboration and enhance learning (Hwang et al., 2006).

Assignment Feedback

Pengitore (2005) states that providing timely, specific, and constructive assignment feedback may be the most powerful tool that can be used to promote student learning. Pengitore also states that although computer software has been developed to assist with feedback automatically, these software features are used with assignments where the lower levels of thinking skills are employed. Recent offerings by course management software companies are aimed at bringing more automation to address the needs of instructors in the area of assessment of higher levels of learning (Scnittman, 2007). Because the provision of feedback in an online course is generally reported by faculty as being more time consuming than the same process in face-to-face courses, teachers often have to choose between the quality of feedback and the timeliness, both of which are important in promoting learning (Steinweg, Williams, & Warren, 2006). Online instructors have a variety of choices to assist in providing both timely and relevant feedback including email, posting of sample work, chat sessions, discussion boards, fax, telephone, exchange of documents with notations, and scanning papers which include hand-written comments (Steinweg, Williams, & Warren).

Nesbit and Burton (2006) build a case that assignment feedback is strongly correlated to student self-efficacy. Students who achieved a lower grade than they had

expected when they made comparisons about their own effort to their perception of the effort and resulting grade of classmates developed a lower level of self-efficacy (Nesbit & Burton). According to Nesbit and Burton, this possible negative spiral should be addressed by teachers communicating in advance with students about grading procedures and expectations to help students develop a realistic expectation of the feedback they will be receiving so that there is not a large discrepancy between the expected and actual grade. Another consideration brought out by Nesbit and Burton is the danger of grade inflation related to teachers' efforts to mitigate the lowering of students' self-efficacy as a result of assignment feedback. This problem can also be alleviated through efforts to give students a realistic expectation of their grade in comparison to their effort on assignments (Nesbit & Burton). Quiñones (1995) found that even the type of assignment given can be perceived as positive or negative feedback when students are assigned tasks that are labeled as remedial or advanced. Thus assignment feedback is an important consideration for teachers when they are trying to build their students' motivation to learn (Quiñones).

Other Digital Communication Tools

Some of the more recently developed digital communication tools include Wiki's, Blogs, and other open source technologies that allow for asynchronous online collaboration. They are seen as enablers for the construction of knowledge by online students and are rapidly being integrated into online learning (Beldarrain, 2006). The broadcasting of audio or video files via the Internet, sometimes referred to as "podcasting" allows teachers and students to easily share up-to-the-minute information with other class members in non-text formats (Beldarrain, 2006). These interactive Web

communication tools are referred to as "Web 2.0", a term coined by Tim O'Reilly of O'Reilly media (Bolan, Canada, & Cullen, 2007). Web 2.0 sites such as YouTube, MySpace, and even commercial sites such as Amazon.com allow users to add media to the site with which other users may interact so that the Web site grows more useful with time. (Bolan et al., 2007). According to Beldarrain (2006) this technology may have an impact on the way teachers deliver instruction in both traditional classrooms and online learning as well as the way students engage in learning and will expand the types of online discussions that future students may widely use. Currently about half the teens in the United States create some kind of Internet content so these highly interactive technologies could rapidly expand to use more of their potential for constructivist learning (Achterman, 2006).

Some disadvantages of these interactive tools involve privacy and safety issues for the students who publish information on the Web (Richardson, 2005). Richardson (2005) feels that the advantages outweigh the risk but state and national laws are just being formulated to address these issues.

A wiki is a Website that allows collaborative authoring by allowing users to add, edit, or remove content (Wiki, 2007). The contrast between a wiki site and a blog site is that users can edit each other's content rather than just respond to it (McPherson, 2006). Some educators favor allowing students to create a wiki in an unrestricted fashion believing that teacher control lessons the usefulness of the tool while others contend that giving the support and instruction that students may need depending on their literacy skills does not detract from the pedagogical benefits (Achterman, 2006). Achterman (2006) identifies several features that make a wiki an effective tool for collaboration

including ease of use, areas for students to create work individually or in groups, ability to use hyperlinks to create a non-linear document, mechanisms that allow reflection, metacognition, and discussion, and features that allow students to view the history of an article and compare changes.

A disadvantage of wikis is the ease with which students can be distracted and follow tangential paths to the intended learning which can make students feel disoriented and frustrated (Achterman, 2006). Another problem is that unreliable information may be repeatedly confirmed in such a way that it seems to students without strong critical thinking skills to be reality (Starnes, 2006). McPherson (2006) sees the fact that students need to be wary of the reliability of information as a valuable tool for teaching literacy skills. Teaching students how to authenticate information through other sources gives them a skill they should also be using with more traditional information resources such as encyclopedias and journal articles (McPherson, 2006).

Web logs or blogs are being encouraged by educators who understand that the public exposure and comment to students' work encourages the students to produce better writing as well as to think more deeply about the topic because of the asynchronous online discussion that may occur (McCloskey, 2006). Disadvantages include the dangers of students being exposed to unwanted or dangerous information (Kirby & Kaillio, 2007). Kirby & Kaillio (2007) site several cases where students have been arrested because of threats or other disruptions to the educational process were contained in their blogs. Laws and court cases involving the Internet are constantly changing but the list of activities that are currently considered punishable due to disruption of education include threats, false statements that may lead to defamation of character, calls for violations of laws or school

rules, and use of school equipment to view or publish non-school sponsored blogs (Kirby & Kaillio, 2007).

Summary

The consensus of many researchers is that the Internet has made a drastic change in education as well as all facets of life and will continue to do so. The development of writing allowed society to retain information beyond what one person could remember. The printing press and the wide-spread teaching of reading allowed mankind to progress to the next level of using information and building knowledge. Only time will tell if the collaborative abilities of software and hardware allowing for rapid construction of knowledge that we have recently seen developing as users read, write and edit one another's creations will be considered by historians to be the third great step in the learning process of mankind. The digital communication tools studied here are those things that make this collaboration between teacher and student as well as between student and student possible.

CHAPTER 3: METHODOLOGY

Introduction

This chapter discusses the methodology utilized in the present study including a description of the pilot study, the design of the study, and the research questions. Also discussed are the setting, the population, sample selection, data collection and the methods of analysis.

Pilot Study

Introduction

A pilot study was conducted during Spring 2006. The participants for the pilot study were taken from the population of students who were enrolled in classes and were near completion or had completed a class with the Florida Virtual School (FLVS) during the spring of 2006. Data was collected in March 2006. The sample for the pilot study was chosen to be students from a single course so those taking that course could be eliminated from the main study in order to avoid duplication of surveying the same student for the pilot study and subsequent main study to be done. Since Physical Education is a required high school course in the State of Florida, and since students from all demographic categories take Physical Education, this course were chosen as the sample for the pilot study. During April of 2006, FLVS secretarial staff emailed a request to participate to parents of students who were enrolled in and had completed 70% or more of the FLVS physical education course (n = 233).Twenty-nine emails were returned as not being valid because the addresses were no longer being used by those parents or had been recorded

incorrectly. Of the remaining 204 requests, nine were returned with a completed survey within the first five day period and another eight were returned after a follow-up request was made to the same parent email address. Survey return dates were monitored and five days after the second request additional returns were deemed unlikely. Thus, the sample size for the pilot study was $N = 17$ with a return rate of 8.3% of the requests that were made to active email addresses.

Instrumentation

The instruments used in this study were the Student Perception of Learning designed by Buckley (2003) and the Academic Motivation Profile Instrument designed by Carey and Pearson (Pearson & Carey, 1995). Some questions from both of these instruments were modified slightly in their wording to allow the survey to address the specific Florida Virtual School online setting. Students were also asked to answer some demographic questions. The survey as used for the pilot study is shown in Appendix A.

Student perception of learning instrument

Buckley developed and tested the Student Perception of Learning instrument (Buckley, 2003). This instrument was used with the authors' permission. Buckley did not provide information on the internal reliability of scores for the Student Perception of Learning Instrument so Cronbach's alpha was calculated for data obtained in the current study and found to be .904. Questions 1 through 8 of the survey as shown in Appendix A are from the Student Perception of Learning Instrument. The questions are designed to determine students' perception of the learning that they did and how that was affected by

interaction with their teacher using the digital communication tools of email, Instant Messaging, chat, telephone, whiteboard, discussion area, and assignment feedback. The wording of the original questions from Buckley was slightly modified where necessary to allow the survey to specifically fit the Florida Virtual School online setting.

Academic motivation profile instrument

Carey and Pearson adapted and tested a motivation scale instrument originally developed by Carey (Pearson, 1992). This instrument was used by permission of Carey. Carey and Pearson found Cronbach's alpha to be .94 for the Academic Motivation Profile. Questions 9 through 18 of the survey as shown in Appendix A are the Academic Motivation Profile Instrument. The questions comprising this instrument were designed to determine how students feel about a course and measure motivation by giving researchers information about student interests and satisfaction regarding the course they were taking.

Demographic and additional questions

Questions 19 through 25 determine use of the digital communication tools and demographic information about the participants. In questions 19 through 25 students were asked to rate their perceptions about their teacher's use of digital communication tools using a five point Likert scale with choices "Very Often", "Often", "Occasionally", "Rarely" and "Never". In question 26 the students were asked which of the digital communication tools were most helpful in assisting them to perform well in the course in which they were enrolled with choices "Email", "Instant Messaging (IM)", "Chat",

"Phone", "Discussion Area", "Whiteboard" and "Assignment Feedback (note from teacher that includes grade)". Questions 27 through 36 gathered demographic data gathered including the number of online courses previously taken, age, gender, whether the student lives in a rural, suburban, or urban setting, course grade, and reason for taking the course.

Pilot Study Findings

Although the sample size was prohibitively small for determining score reliability and validity ($N = 17$), it did provide the opportunity to evaluate the use of the FLVS database system and the selected online survey tool. Emails were sent in March 2006 to selected students' parents requesting permission for their child to participate in this study, giving information about the pilot study and a link to the online survey. Because almost all high school students are under the age of 18, their parents were asked to give permission for their child to participate in an online study in accordance with the University of Central Florida Institutional Review Board (IRB) policies for research with human subjects. A follow up email was sent to the same parent email addresses five days later thanking those students who had already responded and asking those who had not yet done so to respond. This follow up procedure is an adaptation of Dillman's (2001) mail survey procedures for increasing the rate of return. After ten days from the time of the initial email being sent, the results were tabulated and analyzed using techniques planned for the actual research and outlined below. The ease with which a student could respond to the survey in the course of their normal daily activities was designed to help achieve the highest possible response rate although surveys conducted through the Web

have a generally low return rate (Dommeyer, Baum, Hanna, & Chapman, 2004; Kim & Bonk, 2006, Picciano & Seaman, 2006). Kim and Bonk reported a 4% response rate for their survey (Kim & Bonk). The Sloan report of K-12 online learning for 2006 reported only a 2% rate even though requests were sent by mail as well as email and these were sent to adult school administrators rather than young high school students as was done for the current research (Picciano & Seaman).

Although based on a small sample, the findings of the pilot study showed there was a strong possible correlation between students' perception of the teacher's use of tools to enhance learning and motivation score, as measured by the survey instruments. Pearson's correlation coefficient was calculated for the students' perception of teacher's use of tools to enhance learning and motivation score and found to be strong, $r(16) = 0.862$, $p < .05$. The pilot study survey results showed that students reported the most frequently used tools were assignment feedback, the telephone, and email. Students reported the tool they perceived as most useful was assignment feedback, followed by the telephone and email. Eight students (47%) chose assignment feedback as the most useful tool, five students (29%) chose the telephone while four students (24%) chose email.

There was no statistically significant relationship between any of the demographic variables and students' perception of teachers' use of tools to enhance learning or motivation score using various statistical tests as appropriate. Pearson's correlation was used to determine if there were any significant relationships between the interval level variables describing number of online courses taken, age, and grade level in school and the interval level variables that were used to determine the student's perception of teacher's use of digital communication tools as well as motivation score. The eta statistic

was used to explore relationships between the nominal level variables describing urbanicity, reason for taking course, type of school, and ethnic background and the interval level variables that were used to determine the student's perception of the teacher's use of digital communication tools and to determine motivation score. Kendall's Tau was used to find if there were significant relationships between the ordinal level variable describing students' current letter grade in course and the interval level variables that were used to determine the student's perception of the teacher's use of digital communication tools as well as motivation score. Cramer's V was used to determine any relationship between variables describing gender, current letter grade in course, reason for taking course, type of school, and ethnic background with the nominal variable describing the tool that student's found most helpful. None of these comparisons were found to be significant at the $p = .05$ level. The researcher did not find that any changes to the instruments would be needed for this study as a result of conducting the pilot study so the survey instruments for the main study remained the same as those used for the pilot study.

Tests for reliability and validity were not conducted during the pilot study because of the low number of responses received but were conducted in the full study. The pilot study served to alert the researcher that a large number of surveys would need to be sent in order to receive sufficient data for reliability testing to be conducted.

Research Design

The design for this study was survey research. The attitudes and perceptions of students at FLVS toward the teachers' use of digital communication tools were explored. The results may help educators better understand techniques to communicate with, engage, and instruct their students. A survey was given and data collected and analyzed using Pearson's correlation, eta, Kendall's Tau, and Cramer's V.

During this research, students were surveyed in the spring of 2006. These students were enrolled and about to complete an online course or had recently completed an online course at FLVS. The survey was designed to determine student's perception of their teacher's use of digital communication tools to enhance learning, motivation score, and students' perception of the most useful digital communication tool. The survey also included questions about demographics and what the student's grade in the course was at the time they took the survey. The data collected from these students was used to answer the following research questions:

1. What is the relationship between student motivation and teacher interaction for sixth through twelfth grade students in an online setting?
2. To what degree do students perceive that their teachers use the digital communication tools?
3. Which of the communication tools do students perceive to be most helpful?
4. What is the relationship between student learning and student demographics for sixth through twelfth grade students enrolled in online classes?

Setting

The Florida Virtual School, whose offices are located in Orlando, Florida, is a public online school supported by the Florida Legislature. FLVS courses are free to all high school and middle school students in the state of Florida including those who regularly attend public schools, private schools, or are home schooled (FLVS Facts, 2007). FLVS started with 77 enrollments in 1997 (FLVS Facts). As of the 2003-2004 school year an enrollment of 18,000 students and 150 certified teachers made FLVS the nation's largest state supported online initiative for high school students (Symonds, 2003). During the 2005 – 2006 school year over 55,000 half-credit courses were successfully completed by FLVS students (L. Gully FLVS Director of Florida Services, personal communication, August 28, 2006). Florida Virtual School is a public school serving all 67 of the other school districts in the state of Florida. For the 2005 -2006 school year FLVS employed approximately 175 full time teachers located around the state as well as about 100 adjunct teachers. Florida Virtual School offers over 80 high school and middle school courses. All teachers were certified to teach the subject assigned and over 75 of the teachers were National Board Certified teachers. The FLVS has been the recipient of numerous awards including the 2005 United States Distance Learning Association 21st Century Best Practices Award as well as other awards from ITFlorida, *Business Week*, Global Alliance for Transnational Education, and Canadian Association Distance Education (*FLVS Facts,* 2007). By the end of the 2006-2007 school year course completions are expected to be more than 80,000 half credits (L. Gully, personal communication, February 13, 2007).

The use of the FLVS student population for the study provided a wide range of academic subjects as well as students from all types of schools including public schools (72%), home schools (21%), and private schools (7%) (FLVS School Data, 2007). The FLVS students are dispersed across urban, suburban and rural areas with priority for course enrollment given to low-performing public schools, rural schools, and high-minority schools (FLVS Placement Priority Policy, 2007). The FLVS students include a variety of ethnic and cultural backgrounds including White, non-Hispanic (65%), Hispanic (14%), African-American (11%), Asian (3%), Multi-Ethnic (4%) and others (3%) (FLVS School Data, 2007). The FLVS students are 60% female and 40% male (FLVS School Data, 2007).

A comprehensive list of courses offered by the Florida Virtual School is displayed in Appendix C. The school population provided the researcher the ability to gather a sample from a large number of students from a variety of courses and from across the socioeconomic spectrum (FLVS School Data, 2007). As provided by the Florida Legislature, priority for placement in courses is given to students in low-performing public schools, rural schools, and high-minority schools (FLVS Placement Priority Policy, 2007).

Because the intent of the research was to determine which of the digital communication tools student perceive to be most effective at helping develop and maintain positive attitudes in an effort to increase student achievement, those students selected for the study were from the population of students who had been successful in an online course. Success was defined to be those students who had completed 70% or more of their course work.

Florida Virtual School students are evenly distributed in gender with 60% female and 40% male students (FLVS Facts, 2007). Males and females have been shown to be about equally successful in this type of learning environment (Colley, & Comber, 2003; Enoch & Soker, 2006; McCoy & Heafner, 2004, Shin, 2006). These factors made the FLVS students ideal for this study.

Population and Sample Selection

The participants for this study were taken from the population of students who were enrolled in classes and, who either had completed or were near completion of a class during the spring of 2006 at FLVS. The sample for this study was students who were enrolled in FLVS in the spring of 2006 and who had completed 70% or more of the course in which they were enrolled (n=6,023). These courses included the core high school curriculum subjects such as English, mathematics, science, and social studies, elective courses such as Latin, Spanish, web design, life management skills, driver education and a range of College Board approved Advanced Placement courses including English language and composition, English literature and composition, calculus, computer science, biology, art history, macroeconomics, microeconomics, U.S. government, and U.S. history. The list of all courses which were being taken by students who received a survey request is shown in Appendix C. Students who were taking physical education were screened out from the main study because they had been used in the previously conducted pilot study. Students from all of the other high school courses shown in Appendix C were included in the request to participate that was sent by email to parents using the same procedure as was used for the pilot study. The pilot study guided

decisions made in the final data collection. Due to limitations of communicating with students dispersed around the entire state of Florida, the inability to encourage completion of the survey or contact the students in any way other than emails to parents due to FLVS privacy regulations, and the fact that the pilot study showed the return rate would be low, no attempt to survey a strictly random sample was made.

Data Collection

The sample used was made up of those students who voluntarily returned a survey. Data collection for the main study began by sending an email notification to FLVS parents which had an embedded link to the survey Web site. The emails were sent to parents of students who had completed 70% or more of the online course they were taking by spring of 2006. The survey was administered during late April and early May of 2006 when the majority of FLVS students were finished or close to finishing with their classes. This helped ensure the best possible response rate from students as well as gathering the information at a time of the year when the highest number of students was in the target range of 70% or more completed with the course they were taking. The emails were sent by FLVS staff so that the school did not need to disseminate email addresses to the researcher. The email stated to the parents that informing their child of the survey and allowing them to take the survey constituted parental assent. This assent procedure was approved by the University of Central Florida Internal Review Board. After five days a second email reminding parents about the survey was sent. After ten days a commercially produced online survey tool, Zoomerang, was used to generate a data file which included a reference number for each record, the date and time each

participant completed the survey, as well as the response to each question. This file was exported to use with the Statistical Package for the Social Sciences (SPSS) software to enable the researcher to analyze the data.

Dillman and Bowker, (2001) suggest 14 principles for Web survey design which were implemented with the Web-based survey used for this study. These principals include designing the Web survey so that respondents are easily able to answer questions and can easily understand all directions needed to complete the Web survey. The 14 principles also include designing the Web page so that questions are easily read and the overall design does not require amounts of memory that will cause slow operation and completion of the survey (Dillman & Bowker).

Data Analysis

Research Question 1

What is the relationship between student motivation and teacher interaction for sixth through twelfth grade students in an online setting? Pearson's correlation between students' perception of teacher's use tools to enhance learning measured with the Student Perception of Learning instrument and the students' motivation level measured with the Academic Motivation Profile instrument was conducted to answer this research question. The Student Perception of Learning instrument is comprised of questions 1 through 8 of the survey as seen in Appendix A. The Academic Motivation Profile instrument is comprised of questions 9 through 18 of the survey. Composite variables were created for each of these instruments. The composite variables were calculated by averaging each participant's Likert scale responses for the respective instrument.

Research Question 2

To what degree do students perceive that their teachers use the digital communication tools? Frequencies and percentages were computed on items 19-25 (see Appendix A). These questions asked students to rate how frequently their teacher used each of the communication tools.

Research Question 3

Which of the digital communication tools do students perceive to be most helpful to them? Frequencies and percentages were calculated for item 26 (see Appendix A) which asked students to identify the tool that was helpful to them in their learning.

Research Question 4

What is the relationship between student learning and student demographics for sixth through twelfth grade students enrolled in online classes? Correlation coefficients were computed between student demographics (items 27-36) and the composite variables created from the Student Perception of Learning instrument and the Academic Motivation Profile instrument. Pearson's correlation was used in the cases when student demographic items were interval or ratio in scale. Kendall's tau correlation was used when student demographic data was ordinal. Eta correlations were used when demographic data was nominal.

CHAPTER 4: DATA ANALYSIS AND RESULTS

Introduction

This chapter includes information about how the data was collected and analyzed, the reliability and validity of the survey instruments used, and demographic characteristics of the survey respondents. This information is followed by the results related to each of the research questions.

Data Collection

Email requests as seen in Appendix B were sent by FLVS staff to 6988 parents with 965 returns of email addresses that were no longer valid. For the remaining 6023 email requests, 70 responses were received within the first five days of the request, and an additional 196 responses were received after the reminder notice for a total of 266 returns. Thus the response rate for the study was 4.4%. Lafever, Dal, and Matthiasdottir (2006) report that online surveys return rates can commonly be in the 15 to 29% range while other widely used surveys report rates as low as two to four percent (Kim & Bonk, 2006, Picciano & Seaman, 2006)

Reliability

To determine internal reliability of the scores produced from the instruments in the current study, Cronbach's alpha was calculated for scores produced from the Student Perception of Learning instrument and found to be .904. This part of the instrument was designed by Buckley (2003).

For the Academic Motivation Profile, Carey and Pearson (1992) found Cronbach's alpha to be .94. Cronbach's alpha for scores produced from the Academic Motivation Profile Instrument in the current study was found to be .906, which is similar to the value reported by Pearson.

Validity

Student Perception of Learning

A factor analysis of questions 1 through 8 of the instrument used in this study (see Appendix A) which made up the Student Perception of Learning Instrument (Buckley, 2003), extracted a single factor that was responsible for 57.4 percent of the variance. A scree plot confirmed this one factor solution. Figure 1 shows that the Eigenvalues for all of the other components were all less than 1 indicating that these components did not contribute significantly to the variance.

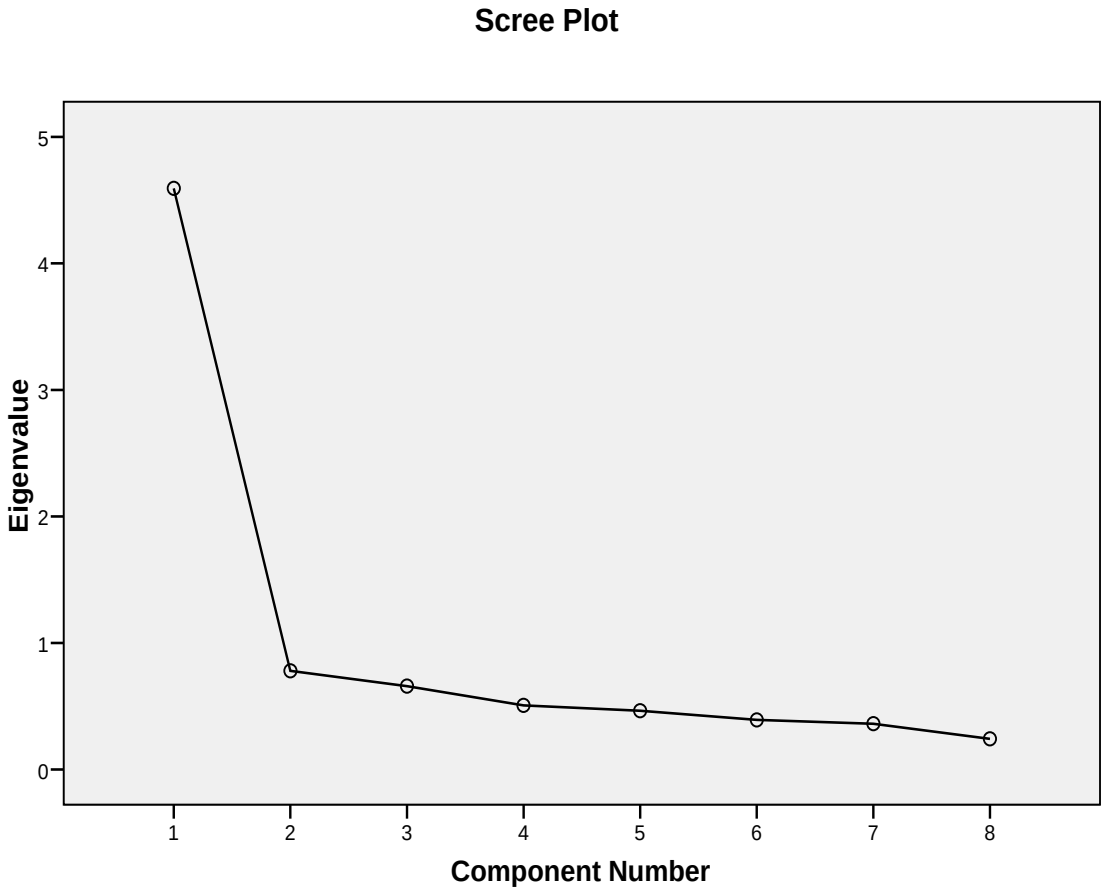


Figure 1. Scree plot verifying a single factor solution for questions 1 – 8.

Table 1 shows a high degree of correlation among the factors. This shows that the oblique rotation is preferable to an orthogonal rotation (Sivo, 2007).

Table 1

Correlation matrix for Student Perception of Learning Items

Question	2	3	4	5	6	7	8
1	.472	.524	.464	.589	.537	.494	.451
2		.624	.451	.503	.500	.465	.438
3			.468	.471	.581	.501	.520
4				.502	.472	.539	.606
5					.684	.512	.435
6						.586	.400
7							.570

Table 2 indicates that all of the questions in this first section of the survey load high on the single extracted factor. This factor will be referred to as "students' perception of teacher's use of tools to enhance learning".

Table 2

Structure Matrix for Student Perception of Learning Items

Question	Component
1	.748
2	.732
3	.775
4	.740
5	.778
6	.791
7	.771
8	.725

Academic Motivation Profile

A factor analysis of questions 9 through 18 of the survey used (see Appendix A) which made up the Academic Motivation Profile Instrument (Pearson, 1992), extracted a single factor that was responsible for 52.3 percent of the variance. A scree plot confirmed this one factor solution. Figure 2 shows that the Eigenvalues for all of the other components were close to or less than 1.

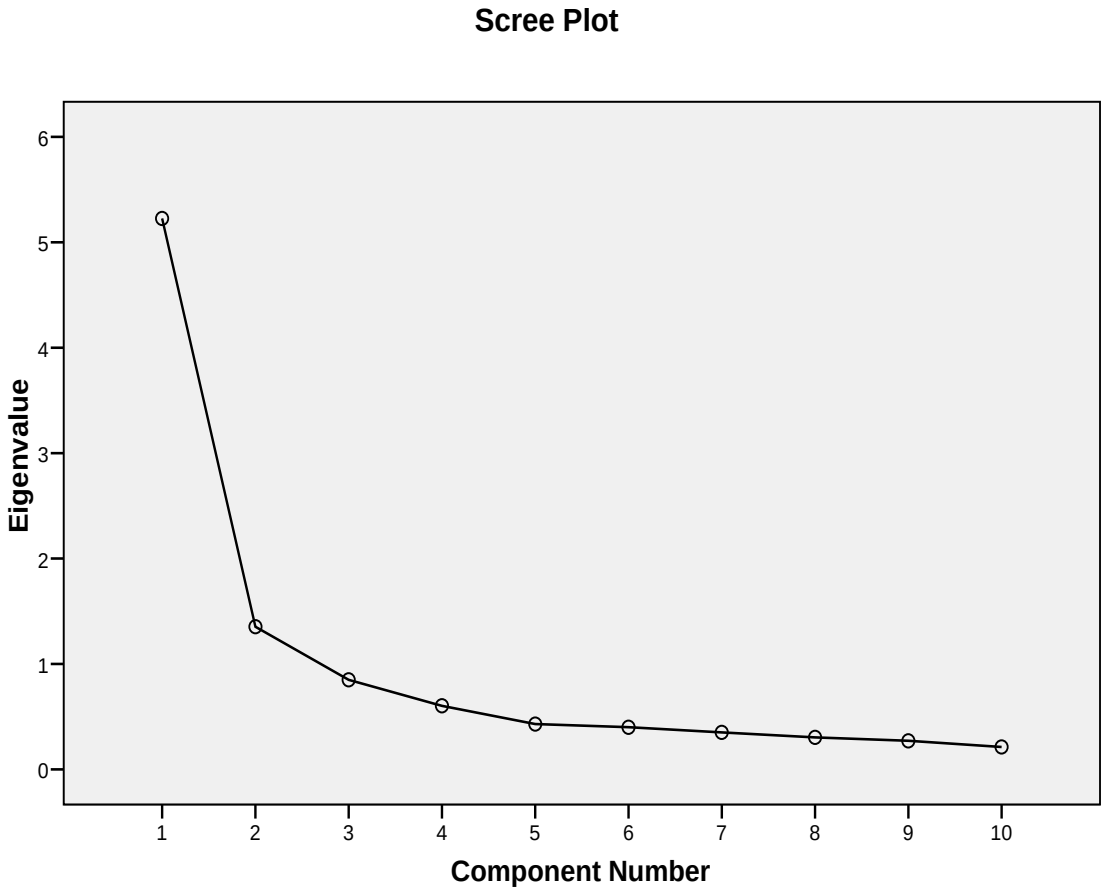


Figure 2. Scree plot verifying a single factor solution for questions 9 – 18.

Table 3 shows a high degree of correlation among the factors. This shows that the oblique rotation is preferable to an orthogonal rotation.

Table 3

Correlation Matrix for Academic Motivation Profile items

Question	10	11	12	13	14	15	16	17	18
9	.443	.704	.143	.317	.276	.557	.554	.419	.517
10		.518	.286	.476	.358	.332	.362	.500	.371
11			.222	.398	.373	.564	.603	.451	.672
12				.521	.655	.288	.332	.345	.316
13					.568	.428	.442	.591	.420
14						.521	.497	.449	.454
15							.682	.519	.632
16								.545	.699
17									.551

Table 4 indicates that all of the questions in this second section of the survey load high on the single extracted factor. This factor will be referred to as “motivation score”.

Table 4

Structure Matrix for Academic Motivation Profile Items

Question	Component 1	Component 2
9	.693	-.477
10	.632	.003
11	.776	-.368
12	.440	.679
13	.705	.409
14	.702	.491
15	.781	-.169
16	.809	-.169
17	.748	.084
18	.798	-.209

Demographics

The population for this study was the group of students taking online classes at the Florida Virtual School during the spring of 2006 who had completed 70% or more of the course in which they were enrolled by the first of April. The sample was made up of 266 students who voluntarily completed an online survey once permission was given by a parent of each participating student.

Since FLVS is a public school open to any middle or high school student in Florida and almost all the FLVS students take only a portion of their curriculum online with FLVS, respondents in this study were asked to identify whether they attended a public, private or home school in addition to the courses they were taking with FLVS. The number of respondents that indicated that they were a public school student was 175 (65.8%). Twenty-one of the respondents (7.9%) attended private school and 66 (24.8%) were home schooled students. Four respondents did not answer this question. Figure 3 shows this distribution. This corresponds closely with current FLVS enrolment demographics of 71% public school students, 7% private school students, and 22% home school students (FLVS School Data, 2007).

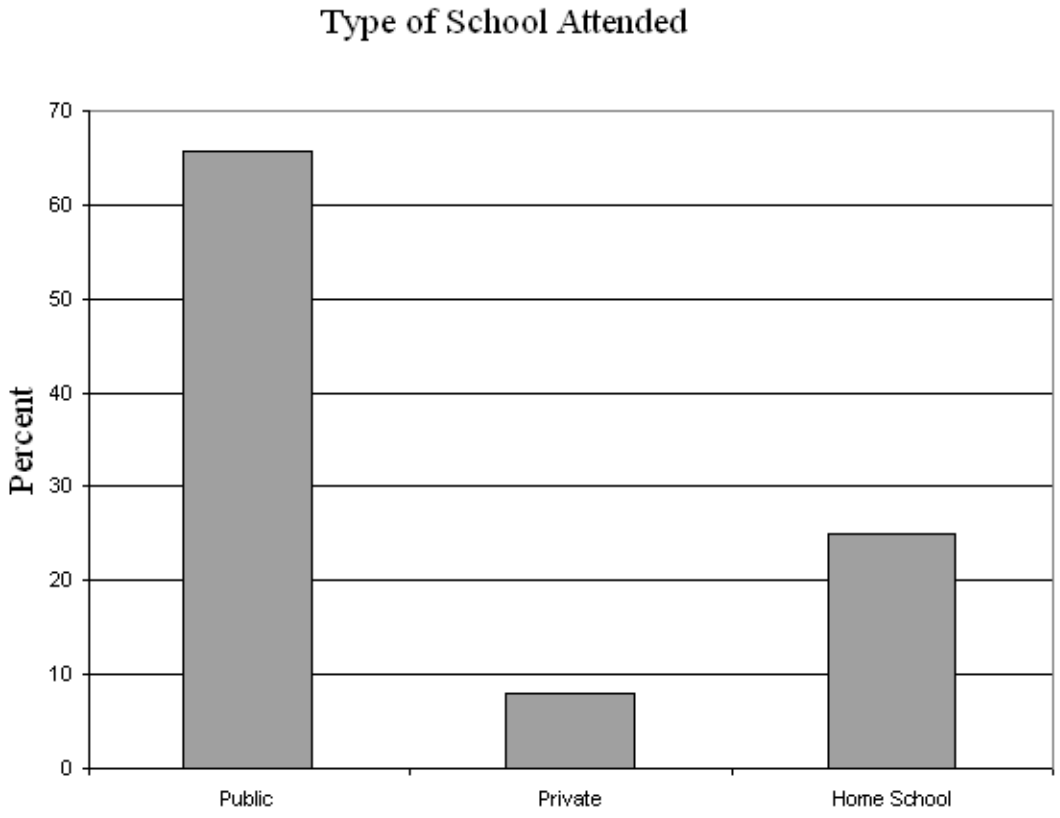


Figure 3. Percents of respondents who attend public, private, or home school.

More than half (58.7%, $n = 155$) of the respondents were taking their first or second online course with FLVS. The mean number of courses taken with 6 being the highest number in the calculation was 2.77. These results can be seen in Table 7.

The FLVS students include a variety of ethnic and cultural backgrounds including White, non-Hispanic (65%), Hispanic (14%), African-American (11%), Asian (3%), Multi-Ethnic (4%) and Others (3%) (FLVS School Data, 2007). The results of the survey showed similar demographics. One hundred ninety-four students reported their ethnic background was White (73%), 30 reported Hispanic (11%), 12 reported Asian (5%), 9 reported Black (3%), and 2 (1%) reported Native American. Fourteen reported their ethnic background was other than these choices while five students did not report ethnic background. Figure 4 displays the percentages of ethnic categories for the FLVS respondents in this study along with those for the general population of the state of Florida (U. S. Census Bureau, 2007). The percentages of Black and Hispanic minorities were less than the state averages for these ethnic groups while the percentages for the White and Asian groups were higher.

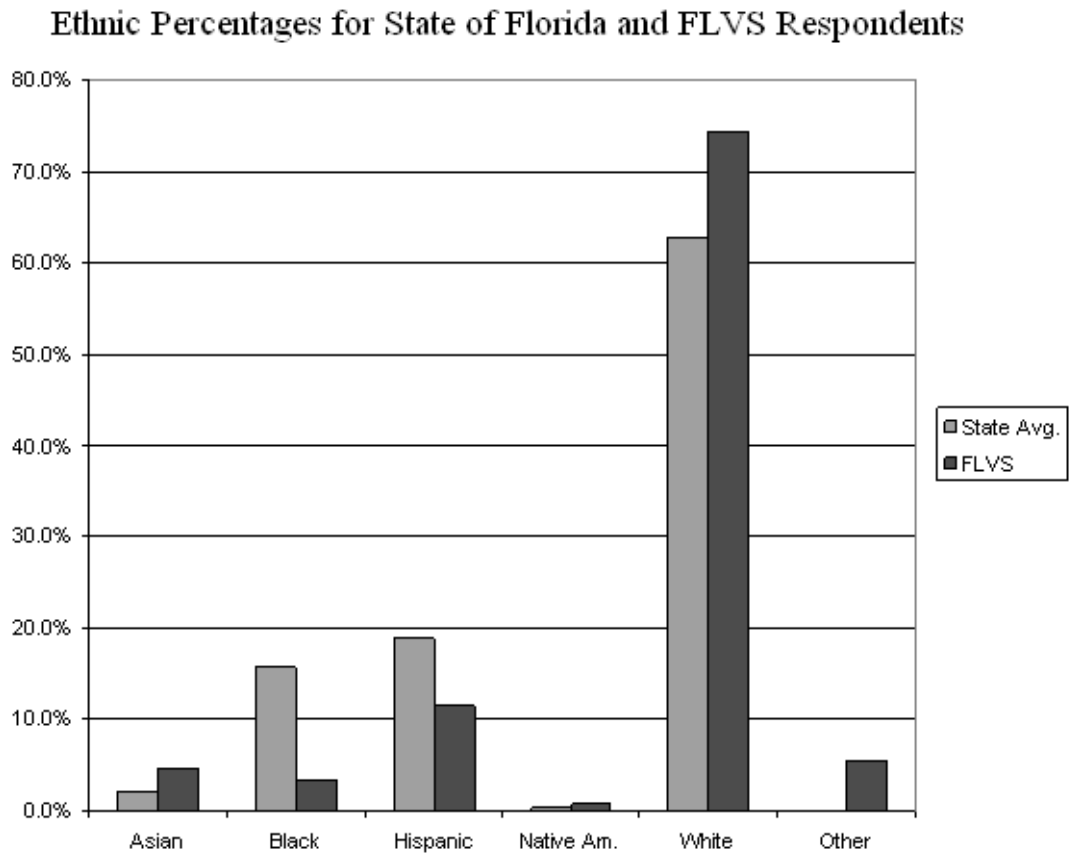


Figure 4. Percentages of ethnic categories for State of Florida and the Florida Virtual School respondents.

For the sample which took the survey 65% (n = 171) reported that they were female with 35% (n = 94) reporting male. The Florida Virtual School student population is about evenly distributed in gender with 60% female and 40% male students (FLVS Facts, 2007).

Table 5 displays how participants indicated whether they lived in a rural, suburban, or urban area.

Table 5

Urbanicity of respondents

Location Type	Frequency	Percent
Rural	48	18
Suburban	163	61
Urban	53	20

The ages as reported by the respondents are shown in Figure 5 which follows. Of the 265 students who reported their age, 190 (72%) were within the ages of 15 to 17.

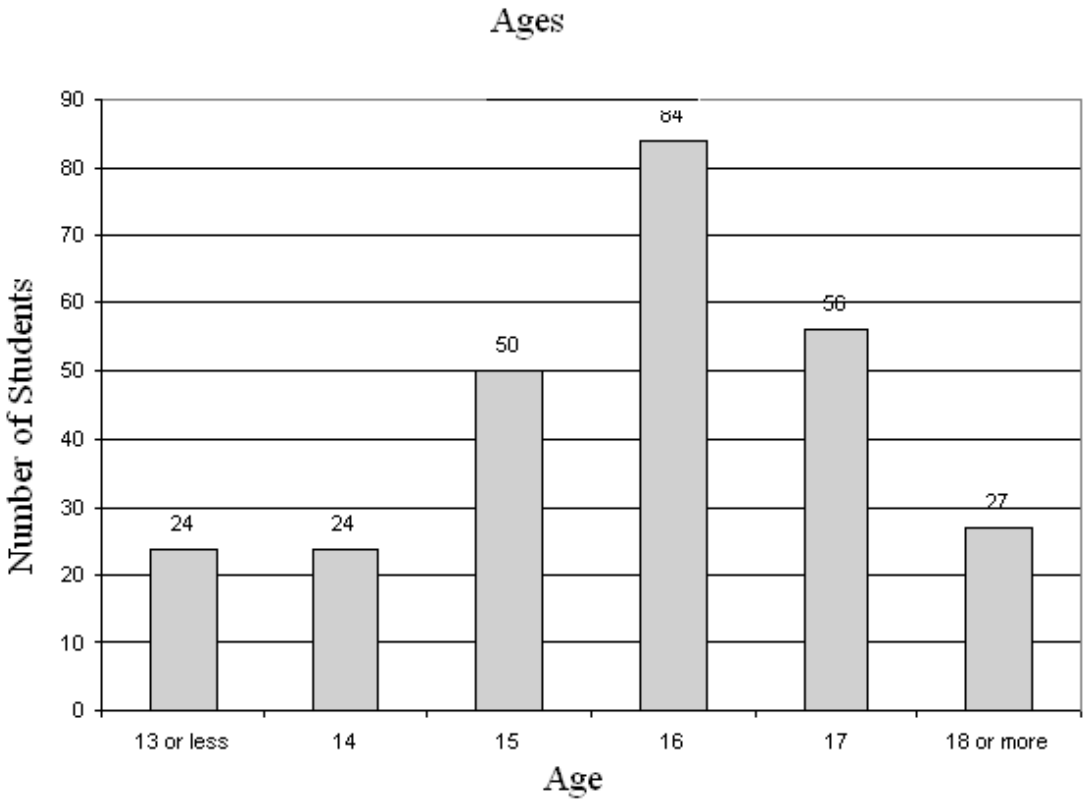


Figure 5. Age distribution of FLVS students who responded to the survey.

The students were asked to report the grade that they had in the course for which they answered the survey questions. The grade distribution among respondents was heavily skewed towards higher grades as seen in Figure 6.

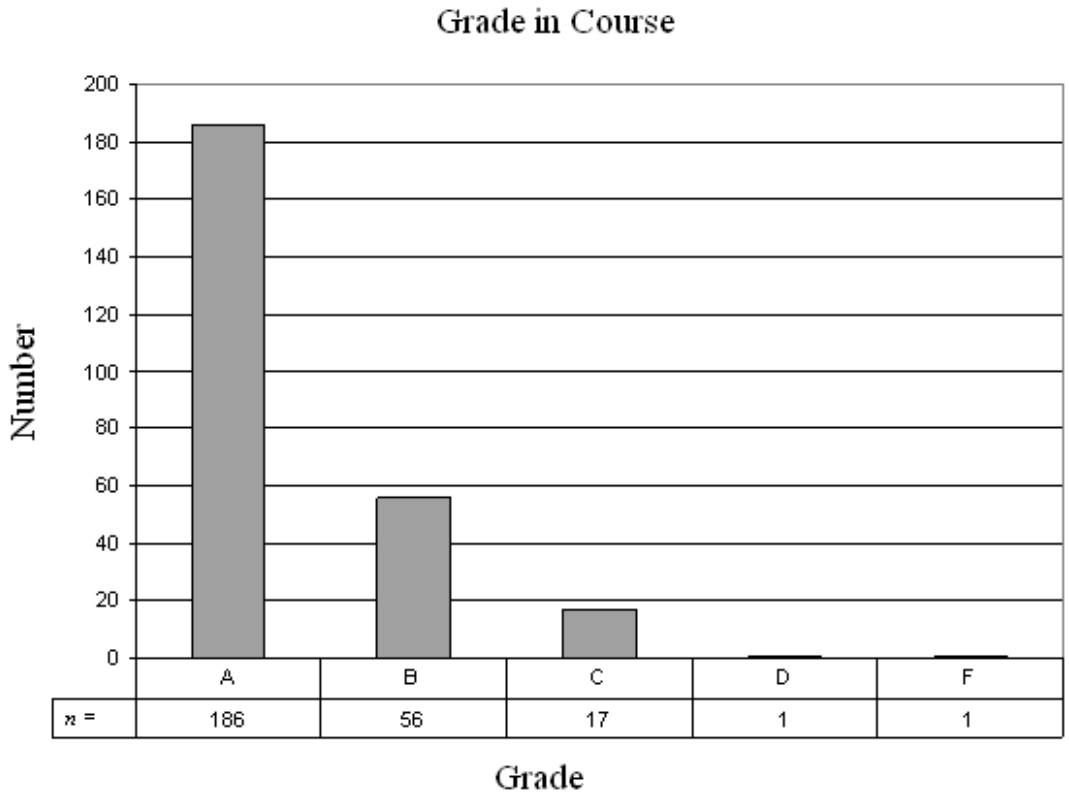


Figure 6. Reported grades of survey respondents.

Table 6 shows the distribution of reasons for taking an online course with FLVS. Table 6 shows that the "other" category was chosen by a high percentage of students (30%, $n = 80$). Other than the reason of freeing up the students' schedule at their traditional school which was chosen by 33% ($n = 87$) of the respondents, this miscellaneous category was chosen by the most respondents indicating that there are many reasons students choose to take an online course.

Table 6

Reasons for Taking Online Course with the Florida Virtual School

Reason for taking course	Frequency	Percent
Free up schedule at traditional school for other courses	87	33
Chance to get ahead	44	16
Previously failed the course or desire grade improvement	37	14
Wanted to take an Advance Placement course	8	3
Homebound or unable to attend school for health reasons	8	3
Other	80	30

Florida Virtual School serves students taking middle school and high school courses (FLVS Facts, 2007). In a few cases, younger students take a middle school or high school course as reflected in the "Other" category of Figure 7 which shows the distribution of the grade level of the respondents.

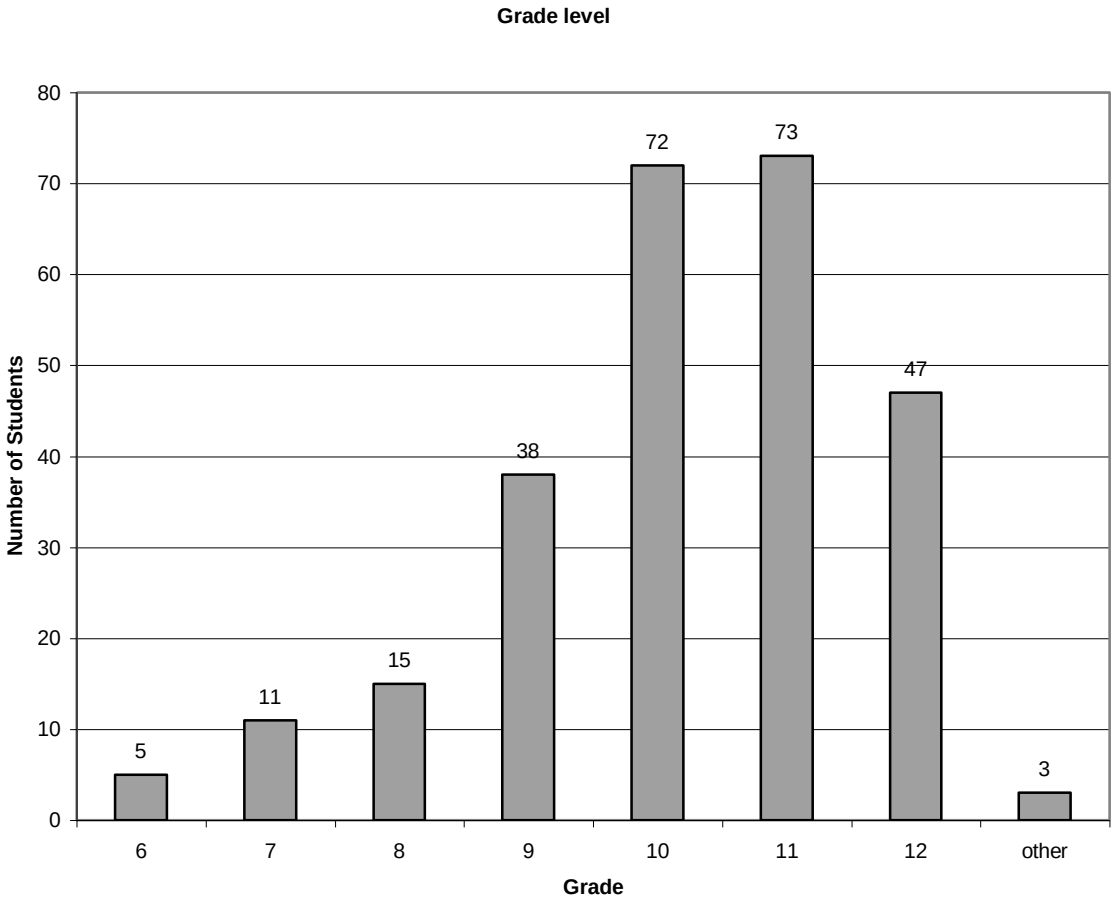


Figure 7. Grade level distribution of respondents.

Research Question 1

To answer research question 1, "What is the relationship between student motivation and teacher interaction for sixth through twelfth grade students in an online setting", a Pearson's correlation was computed between the composite variables for students' perception of teacher's use of tools to enhance learning and motivation score was conducted. The variable describing students' perception of teacher's use of tools to enhance learning was calculated using the Student Perception of Learning instrument, and the motivation score variable was calculated using the Academic Motivation Profile

instrument. Pearson's correlation coefficient indicated a strong positive correlation between students' perception of teacher's use of tools to enhance learning and motivation score ($r(265) = .753$, $r^2 = .567$, $p < 0.01$) with a large effect size (Cohen, 1988). A scatterplot of students' perception of teacher's use of tools to enhance learning and motivation score is presented in Figure 8. A visual inspection of the data points confirms the assumption that the data is linear. The assumption of independence cannot be made due to the fact that survey completers were not randomly selected.

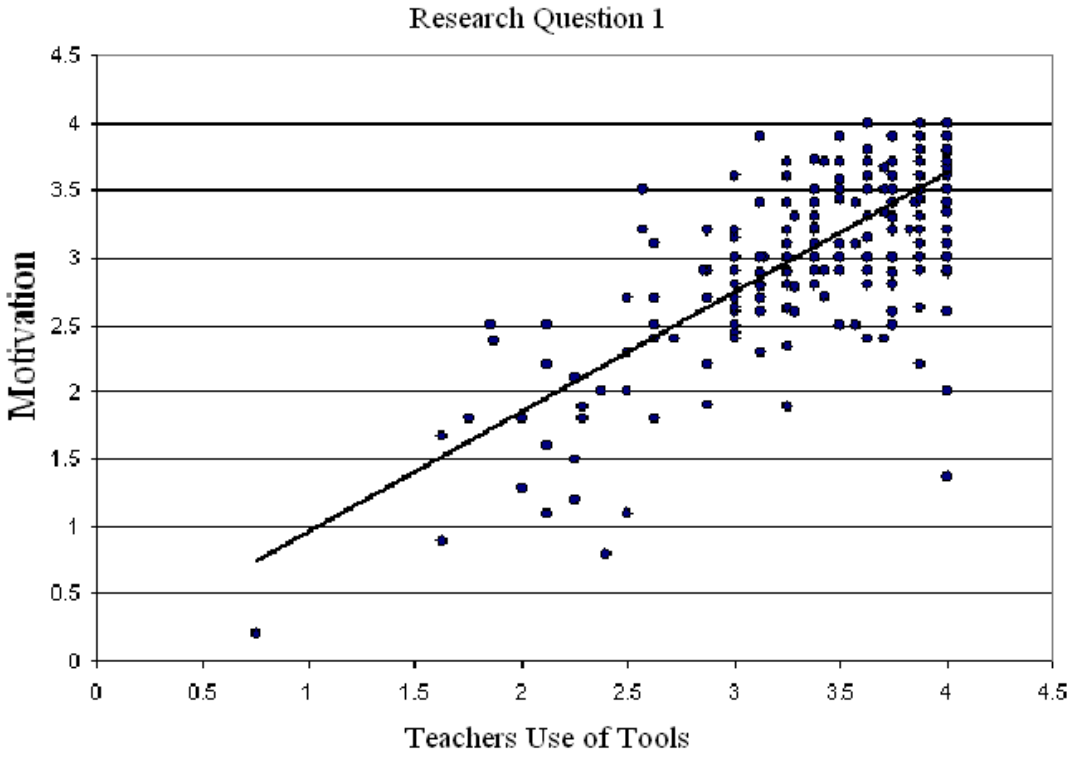


Figure 8. Scatterplot of students' perception of teacher's use of tools to enhance learning and motivation score.

Research Question 2

To answer research question 2, "To what degree do students perceive that their teachers use the digital communication tools", a comparison of the rankings with which students evaluated each digital communication tool was made to determine their frequency of use.

Students rated each of the digital communication tools according to whether they perceived that their teacher used that tool never, rarely, occasionally, often, or very often. Table 7 shows the frequency and percentage of students who rated each tool in each of these categories. The tools which were rated by students as being used most often were email, telephone, and assignment feedback. The percentage of students who reported that their teacher used email often or very often was 87.6% (n = 133) with only 1.5% (n = 4) reporting that their teacher never used email and 3.8% (n = 10) reporting that their teacher rarely used email. Assignment feedback was reported to be used often or very often by 75.2% (n = 200) of the students, and the telephone was reported as having been used often or very often by 65.8% (n = 175) of the students. The other tools were rated as being used much less often by the students. The percentage of students who stated that discussion area was used either often or very often was 20.3% (n = 54). For IM the rating was 9.4% (n = 25), whiteboard, 9.1% (n = 24) and chat, 7.1% (n = 19).

Table 7

Student Perception of Frequency of Use of Digital Communication Tools

	Very Often		Often		Occasionally		Rarely		Never		NA	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Email	137	51.5	96	36.1	19	7.1	10	3.8	4	1.5	0	0
IM	15	5.6	10	3.8	18	6.8	14	5.3	180	67.7	29	10.9
Chat	8	3.0	11	4.1	21	7.9	19	7.1	179	67.3	28	10.5
Telephone	101	38.0	74	27.8	76	28.6	15	5.6	0	0.0	0	0
Discussion	21	7.9	33	12.4	63	23.7	44	16.5	91	34.2	14	5.3
Whiteboard	14	5.3	10	3.8	23	8.6	30	11.3	165	62.0	24	9.0
Assignment Feedback	119	44.7	81	30.5	38	14.3	19	7.1	7	2.6	2	0.7

Note. NA represents "not applicable".

Figure 9 shows that email, telephone, and assignment feedback were used often, while IM, chat, discussion, and whiteboard were used much less often. A high percentage of students chose either "very often" or "often" for these three tools while very few made these choices for the other tools.

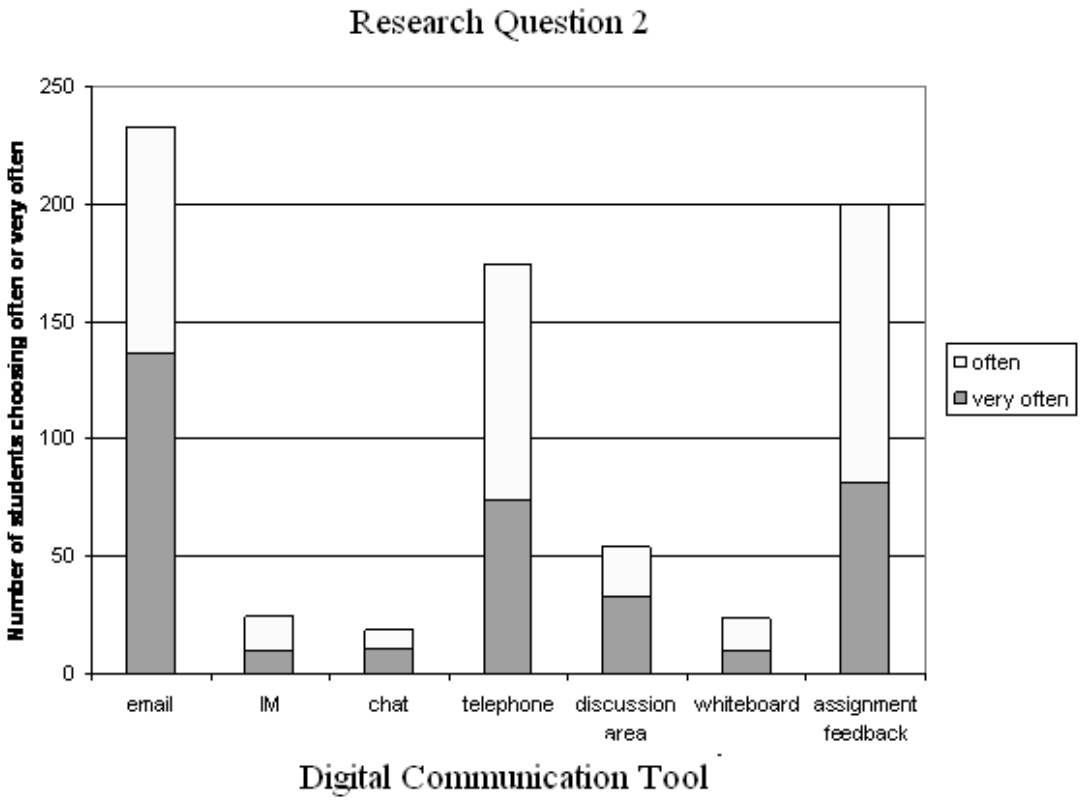


Figure 9: Number of students indicating that their teacher used the digital communication tool often or very often.

Research Question 3

Percentages and frequencies were calculated to answer research question 3, "Which of the digital communication tools do students perceive to be most helpful?"

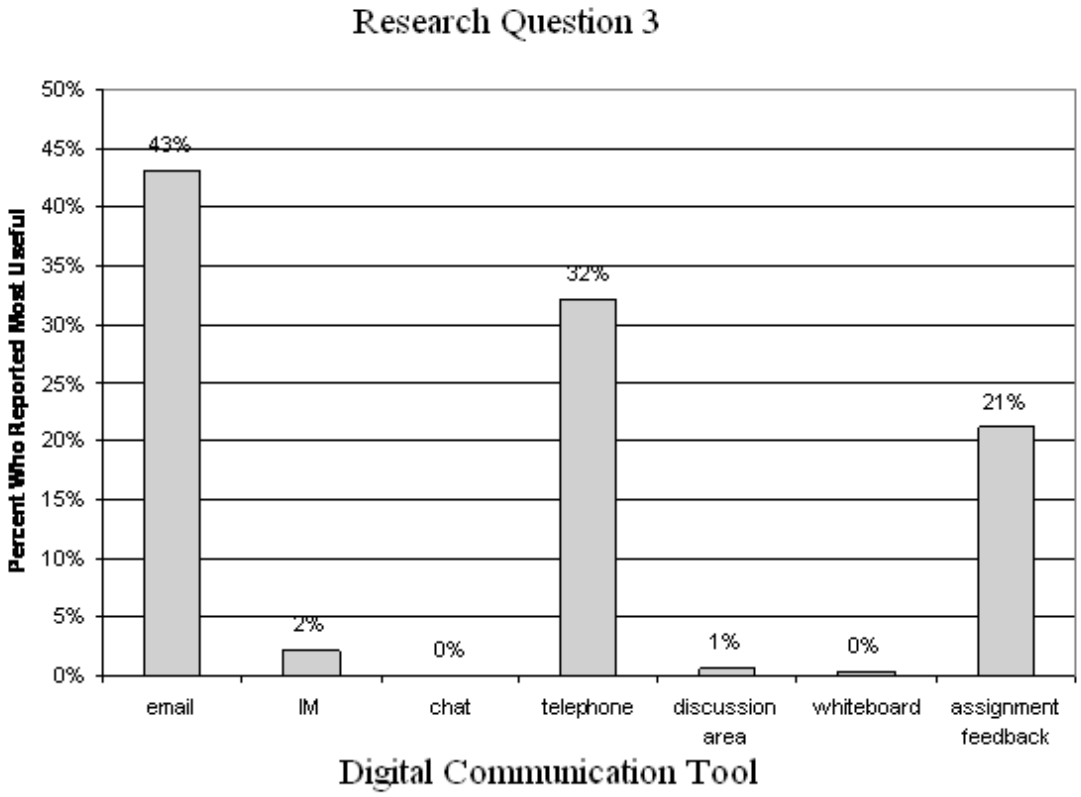


Figure 10: Percentages of students who reported each digital communication tool was the most helpful to changing their learning during the course they were taking.

Forty-three percent (n = 114) of the students felt that email was the most useful tool in enhancing their learning. Thirty-two percent (n = 85) of the students felt that the telephone was the most useful tool and 21% (n = 56) listed assignment feedback as being most helpful. The assignment feedback comes to students via email but is distinguished from those emails in which students simply request an answer to a question or where the

teacher is giving some direction because assignment feedback includes the grade given to the student. The combination of these two forms of digital communication resulted in a total of 64% (n = 170) of students reporting that they were most assisted in their learning by the use of email and assignment feedback. This is 100% higher than those who felt that the telephone, the only auditory tool included in the study, was the most useful tool.

Research Question 4

To answer research question 4, "What is the relationship between student learning and student demographics for sixth through twelfth grade students enrolled in online classes?", correlations were calculated between students' perception of teacher's use of tools to enhance learning and demographic variables. Correlations were also calculated between motivation score and demographic variables as well as between most useful tool and demographic variables.

Number of Courses Taken at FLVS

Pearson's correlation was calculated to see if there is a relationship between the students' perception of the teacher's use of tools to enhance learning and the number of courses the student had taken. The survey question allowed students to choose a number from one through five or six or more courses taken at FLVS. Of the 266 respondents, two did not answer this question. Frequencies and percentages are displayed in Table 8.

Table 8

Number of courses taken at FLVS

Number of Courses Taken	Frequency	Percent
1	91	34.5%
2	64	24.2%
3	27	10.2%
4	22	8.3%
5	18	6.8%
6 or more	42	15.9%

A correlation was calculated to determine the relationship between number of courses taken and students' perception of the teacher's use of tools to enhance learning. The results suggest a weak relationship, $r(265) = -.017$, $r^2 = .003$, $p = .782$, with small effect size. A visual inspection of a scatterplot of the data points confirmed the assumption that the data is linear.

Pearson's correlation was calculated between the students' motivation score and the number of courses taken and found to be significant at the .05 level. This indicates that students who have taken several courses with FLVS would be likely to score higher on the motivation portion of the survey than students who had taken only one or two courses with FLVS , $r(265) = .128$, $r^2 = .016$, $p = .038$, with small effect size. A visual inspection of a scatterplot the data points confirmed the assumption that the data is linear.

Pearson's correlation coefficient was found for each of the variables regarding weather email, telephone, and assignment feedback was felt to be the most useful tool. There was not a statistically significant relationship between the number of courses taken at FLVS and a) email ($r(265) = -.031$, $r^2 < .001$, $p = .614$, indicating a weak relationship with small effect size), b) telephone ($r(265) = .008$, $r^2 < .001$, $p = .901$, weak relationship, small effect size), or c) assignment feedback ($r(265) = .041$, $r^2 = .002$, $p = .505$, also indicating a weak relationship with small effect size). Few students made a choice other than email, the telephone or assignment feedback (as seen in Figure 10 above) so the other variables were not investigated in to determine relationship to number of online courses taken at FLVS.

Age

To determine if a statistically significant relationship existed between age and students' perception of the teacher's use of tools to enhance learning or the motivation score Pearson's correlation coefficient was calculated. A weak non-significant relationship was found ($r(265) = -.006$, $r^2 < .001$, $p = .924$) with small effect size. Similarly Pearson's correlation coefficient showed no statistically significant relationship between age and the motivation score ($r(265) = .027$, $r^2 = .001$, $p = .668$) with small effect size. An examination of scatterplots indicated that the data is linearly distributed and the assumption of bivariate normality is met. The assumption of independence cannot be made due to the fact that survey completers were not randomly selected.

Gender

Since gender is a dichotomous variable and student's perception of teacher's use of tools to enhance learning is an interval level variable, Pearson's correlation was used to determine if a relationship existed between these variables. The results indicate that gender has only a weak relationship with students' perception of teacher's use of tools to enhance learning, $r(264) = .052$, $r^2 = .003$, $p = .399$, with small effect size. A visual inspection of a scatterplot of the data points confirmed the assumption that the data is linear.

Pearson's correlation was also used to determine association between gender and motivation score. The correlation indicated no statistically significant relationship between gender and motivation score, $r\ (264) = .021$, $r^2 < .001$, $p = .738$, with small effect size. A visual inspection of a scatterplot the data points confirmed the assumption that the data is linear.

Cramer's V was used to determine if there was any relationship between gender and the tool selected as most useful (email, IM, chat, telephone, discussion area, whiteboard, or assignment feedback) since both of these variables are at the nominal level. No significant relationship was found with a weak relationship ($V = .133$, $p = .459$).

Rural, Suburban, or Urban Location

The Spearman rank correlation coefficient showed very little association, with small effect size, between students' perception of teacher's use of tools to enhance learning and the location where a student lives (rural, suburban, urban), ($r_s(263) = -.014$, $p = .820$). The correlation between location where the student lives and motivation score

was also not statistically significant and had a small effect size, ($r_s(263) = -.108$, $p = .081$).

Current Letter Grade in Course

Respondents were asked to report their current grade either in the course in which they were enrolled or the final grade in the course if they had already completed it (Question 31, Appendix A). To determine the relationship between the reported grade and students' perception of teacher's use of tools to enhance learning Kendall's tau was computed. The correlation coefficient suggested a weak relationship between students' perception of teacher's use of tools to enhance learning and current letter grade in course ($\tau\,(265) = -.013$, $p = .807$). A visual inspection of a scatterplot of the data points confirmed the assumption that the data is linear.

Kendall's tau was also computed to determine the relationship between grade received in course and motivation score. The reported grade in a course was somewhat associated with motivation score ($\tau\,(265) = -.098$, $p = .051$). A visual inspection of a scatterplot of the data points confirmed the assumption that the data is linear.

Cramer's V was used to find if any statistically significant relationship exists between the students' reported grade and their choice of the most useful tool. This indicates that these variables have only a weak relationship ($V\,(265) = .156$, $p = .190$).

Reason for Taking Course

Students were asked to choose among the following reasons for taking the course: free up schedule at traditional school for other courses, chance to get ahead, previously

failed the course or desire grade improvement, wanted to take an Advanced Placement course, homebound or unable to attend school for health reasons, or other. This nominal level variable (item number 32 on the survey instrument) was tested using an eta value to find if there was significant correlation with students' perception of teacher's use of tools to enhance learning. This result shows little correlation between these two variables (η (263) =.292, p = .072).

The correlation coefficient for comparison with reason for taking course and motivation score shows a weak relationship, (η (263) = .435) , with medium effect size. To discover any association between the reason for taking the course (item 32 on the survey instrument) and the tool chosen as most useful, (email, IM, chat, telephone, discussion area, whiteboard, or assignment feedback). Cramer's V was used and the relationship was found to be not significant (V(262) = .166, p = .072).

Grade Level in School

Grade level in school was also not significantly correlated with the variables describing students' perception of teacher's use of tools to enhance learning. Pearson's correlation was calculated showing a weak relationship (r (265) = -.044, p = .474) with small effect size. Pearson's correlation was also calculated for grade level in school and motivation score showing a weak relationship (r (265) = -.003, p = .956) with small effect size. A visual inspection of scatterplots of the data points confirmed the assumption that the data is linear. Cramer's V was used to determine the relationship between grade level in school and choice of tool that was most useful in the course (V (262) = .193, p = .062) with small effect size.

Type of School

To determine correlation between the type of school (public, private, home) and students' perception of teacher's use of tools to enhance learning, the eta statistic was calculated. Little association was found for these variables, η (265) = .324, p = .039, with medium effect size.

To find if there was a relationship between the type of school and motivation score eta was again used, η (265) = .405, p = .065, with medium effect size. There was little correlation between the two variables.

Cramer's V was used to search for association between type of school and choice of most useful tool. No significant relationship was found (V (265) = .117, p = .713).

Ethnic Background

Due to the small numbers of survey respondents who chose some of the ethnic categories, the ethnicities were collapsed into the groups White (65%), Hispanic (14%), Black (11%) and Other (10%). There was not a statistically significant relationship between ethnicity and students' perception of teacher's use of tools to enhance learning, η(261) = .151, with small effect size.

The same groups were used to determine relationship between ethnicity and the variable describing motivation score. No significant correlation was found, η (261) = .124, with small effect size.

To discover if there was significant association between the digital communication tool that the student felt most helpful and ethnic background Cramer's V was used. No significant association between these variables was found (V (265) = .170, p = .052).

CHAPTER 5: CONCLUSIONS

Discussion

The purpose of this study was to determine the degree to which selected communication tools used by teachers who teach online are positively perceived by their students in improving feelings of self-efficacy and motivation, and which tools may be perceived to be significantly more effective than the others. The research questions were:

1. What is the relationship between student motivation and teacher interaction for sixth through twelfth grade students in an online setting?
2. To what degree do students perceive that their teachers use the digital communication tools?
3. Which of the digital communication tools do students perceive to be most helpful?
4. What is the relationship between student learning and student demographics for sixth through twelfth grade students enrolled in online classes?

The communication tools selected for the study were selected from the ones which were being used at The Florida Virtual School (FLVS) during the spring of the 2006 school year when students were surveyed. They included email, Instant Messaging (IM), chat, the telephone, discussion area, whiteboard, and assignment feedback. Florida Virtual School courses are designed so that students receive their instruction through Web pages, then use the aforementioned tools to ask questions, discuss ideas, turn in assignments, and carry out the communication with their teacher, as well as with classmates, that is necessary for knowledge to be constructed and learning to occur.

Students could use email to ask specific questions that arose while doing the assigned activities that were not addressed in the main lesson material. They were also able to use IM, chat, or the telephone to contact their teacher with questions. Students were directed to the discussion area of their course delivery software by some of the lessons. Teachers were also able to send students information about discussion assignments and moderate student's comments in the discussion area. Students used whiteboard software to interact with teachers individually in such courses as mathematics where written as well as oral synchronous communication was important to the learning process. The whiteboard software that was used allowed for synchronous chat to be conducted in addition to the students and teachers interacting on the whiteboard itself. The whiteboard facilitates the use of symbols and drawing with the mouse whereas chat allows only keyboard characters to be used.

Assignment feedback was automatically generated when a teacher graded an assignment for the course. The grade plus any related comments and attachments that the teacher wanted to send to the students were sent by email to the student as well as posted to the student's individual grade book Web page which was accessible to the student, parent, and traditional school guidance counselor. Teachers could opt to send copies of the email to parents and guidance counselors in addition to the student as they felt necessary. In the survey instruments assignment feedback was distinguished from regular email by the fact that it included the grade for a specific assignment.

This research study has shown that the use of email, the telephone, and assignment feedback were perceived by students to be more effective than the use of IM, chat, the discussion area of the course, or the whiteboard. It may be that certain tools

were chosen by survey respondents as more helpful because those same tools were also among the most frequently used.

Asynchronous online discussions have been noted in the literature as being very important to learning. The analysis of this study shows them to be used more frequently at the Florida Virtual School (FLVS) than IM, chat, or the whiteboard. The students surveyed, however, clearly did not see these types of discussions as the most helpful tool in their learning. This study involved mostly high school students. Previous studies involved college and graduate level students which may have had an effect on the results. Recent studies noted that younger students may tend to prefer learning at the knowledge level rather than stretching to the analysis and synthesis levels, which are required for participation in discussions and are often cited in the literature as the reason that the use of discussion is beneficial to the construction of knowledge (Beldarrain, 2006; Bird, 2007; Hines & Pearl, 2004; Johnson, 2006; Prewitt, 1998; Shieh, 2006; Wang & Woo, 2007; Yukselturk & Top, 2006).

The results described in this study inform teachers who conduct online courses that a high usage level of digitally mediated communication and motivation to learn are strongly correlated. This study shows that students perceive that the use of email, the telephone, and assignment feedback are important to their success in learning which confirms earlier research that shows there is value in both synchronous and asynchronous communication (Beldarrain, 2006; Shieh, 2006; Yukselturk & Top, 2006). The various demographic categories did not have significant correlation with students' perception of teacher's use of tools to enhance learning, with the motivation score, or with the students' choice of most useful digital communication tools. This indicates that the other findings

for this study's research questions will be useful to teachers working both with experienced and non-experienced online learners, and with all ages of both genders, from rural, suburban or urban settings.

Conclusions

Research Question 1

What is the relationship between student motivation and teacher interaction for sixth through twelfth grade students in an online setting? In the attempt to find any relationship between teacher interaction in an online setting and student motivation, variables were calculated to determine students' perception of teacher's use of tools to enhance learning and to determine a motivation score. While the calculated variables resulted in high positive correlation between students' perception of teachers use of tools to enhance learning and their motivation score, no causation can be inferred. A reasonable conclusion appears to be that students' motivation is increased by frequent communication with their teacher rather than the converse possibility that a natural high level of motivation causes students to believe their teacher communicates frequently. A logical conclusion is that teachers who teach online should use whatever communication tools they have at their disposal to frequently interact with their students and that improved student achievement is a likely result. Frequent interaction between teacher and student corresponds significantly and directly with a high level of student motivation. This research compliments current findings that there will be more positive learner outcomes if there is a higher level of communication between teacher and student (Kim

& Bonk, 2006; Johnston 2004; Pengitore, 2005; Silverman, 2001; Smith et al. 2001; Tello, 2002).

Research Question 2

To what degree do students perceive that their teachers use the digital communication tools? The three tools that students reported using most frequently when their teachers communicated with them were email, the telephone, and assignment feedback. During the time that a student is taking a course at FLVS, both the teacher and student are able to make choices among the tools examined in this study. Teachers and students may choose the communication tool that seems the most useful or convenient to them at the moment. The tools of email, the telephone, and assignment feedback were reported by more students as being used frequently than the other tools, but the use of these tools is probably somewhat driven by course design. For example, a course will normally have at least a few, and maybe several, assignments due each week. Students would therefore receive assignment feedback frequently. The fact that one tool was used frequently does not preclude the others from being used frequently as well. Email and the telephone were also rated as being used often or very often by the vast majority of the students who participated in the survey. Although some of the other digital communication tools such as IM and chat are described in the literature as being popular with students (DeGennaro, 2005; Gee, 2006; Hines & Pearl, 2004;McCloskey, 2006; Pan & Sullivan, 2005; Pelowski, Frissell, Cabral, & Yu, 2005; Presnky, 2005; Texley, 2005), a small percentage of the FLVS students rated these as being used frequently in their course.

Research Question 3

Which of the digital communication tools do students perceive to be most helpful? The finding that FLVS students indicated asynchronous written communication, including email and assignment feedback, was very helpful to them in their course work indicates that teachers may need to make use of these tools on a regular basis to maintain and build students' motivation to learn in their online courses. These findings agree with statements by Pengitore (2005) and Steinweg (2006) who indicated that timely and substantive feedback was essential for quality distance learning. What is new with the findings in this research study is that feedback can be (and may even be preferred to be) asynchronous. Assignment feedback was used almost as frequently as email but students rated it much less useful to them than email. It should be noted that students may have found assignment feedback more helpful when it was positive and they receive high grades. In comparison, email responses from teachers would almost always have a positive tone. There were no grades attached to emails to give the students a negative feeling. These facts may influence students' thoughts about which one of the tools was most helpful to them.

Telephone feedback was chosen by students as the second most helpful communication tool with one-third of the students preferring this mode of communication. Little is mentioned in the literature about the use of the telephone in online learning. A recent study compared face-to-face tutoring assistance with some use of telephone and email with online tutoring assistance which also included the use of email (Price 2006). In the Price study it was found that face-to-face and telephone interaction were preferred to online tutoring service. The students in the Price study were

mature adults rather than high school age. In a much earlier study Olgren (1997) discussed long standing benefits of audio conferencing but this study only referred to group audio conferencing and how it was used as a teaching tool rather than individual discussions between teacher and student. The fact that personal calls are regularly held by FLVS teachers and students may explain why this communication mode was considered highly useful by the students in helping them with their course. The telephone was highly rated by FLVS, but it is infrequently mentioned in distance learning literature.

Instant Messaging is a tool that today's students use heavily in communication with friends (Martin, 2006). Today's millennial generation has replaced some face-to-face conversation with email and IM with three of every four teens reporting that they use IM to communicate with friends (Scheick, 2007). In this study, IM was chosen as "most useful tool" by only 2% of students. Contreras-Castillo (2006) found that students who had an IM feature built into their courseware used it mainly for socializing but that there were instances where it supported learning. Since IM was only chosen as the most helpful communication tool by 2% of students, this mode of communication may be, in this study, a lesser used tool.

Researchers have consistently confirmed that asynchronous online discussion is valuable for learning at the analysis, synthesis, and evaluation levels of Bloom's taxonomy (Ely, 2002; Freedman, 2003; Hines, 2004; Johnson, 2006; Swan, 2002; Tello, 2002). The participants in this study contradicted these research findings because they did not perceive discussion to be the most valuable tool. Only 1% of them selected this choice.

Mash et al. (2005) compared chat and discussion to interactive television and found that a course containing chat and discussion features supported effective student-to-student communication and was superior to even synchronous interactive television in creating a constructivist learning environment. Very few FLVS respondents in this study rated chat, discussion area, or the whiteboard as the most helpful tool. Each of these communication tools were chosen by less than one percent of the survey respondents.

Research Question 4

What is the relationship between student learning and student demographics for sixth through twelfth grade students enrolled in online classes? The calculated variables describing students' perception of teacher's use of tools to enhance learning and motivation score were used. Correlations between these variables and various demographic variables were conducted as well as for the students' choice of the most helpful tool. Few studies in the literature make comparisons such as these among the various demographic categories.

The first demographic variable investigated was the number of FLVS courses a student had taken including the one in which they were currently enrolled at FLVS. Students could choose one course, two, three, four, five, or six or more courses for their answer to this demographic question on the survey instrument. To determine if the number of courses taken had a relationship to either students' perception teacher's use of tools to enhance learning or motivation scores, correlations were calculated between both of these variables and the number of online courses the student had taken. Although participants' perception of their teacher's use of tools to enhance learning was not

significantly correlated to the number of courses they had taken with FLVS, the number of courses taken was significantly correlated with motivation score. Those students who had taken more courses showed a higher motivation score. This could indicate one of two things; either those students who have taken a number of courses with FLVS have had an increase in the level of their motivation score or students who are naturally highly motivated tend to take multiple courses with FLVS. Since correlation between the variables does not show the direction of the effect, it may be a possibility that taking multiple FLVS courses improves the motivation score. One explanation of this significant correlation may be that the more courses a student has taken the more experience they would have in this type of learning environment. This could mean that they have constructed an understanding of how to communicate with their teachers and have a higher comfort level with the use of the digital communication tools. Familiarity with the communication tools that is a result of taking previous courses may mean that repeating students have an advantage over those students who are new. This is something that teachers who teach online might consider when beginning a new class. Those students who are less familiar with communication via digital tools may need a little more help and encouragement from the teacher. One can learn from the positive correlation between number of online courses previously taken and motivation score that gathering information about a students' previous experience early in the course may be an effective teaching technique for teachers.

Another observation about the number of FLVS courses taken (including the current course) is that the average number of FLVS courses taken by the respondents was three. In the 2006 – 2007 school year, FLVS reports serving 52,000 students who took a

total of 87,000 courses for a calculated average of 1.7 courses per student per year (FLVS Facts, 2007). The data collected for this research study reveals that 63% of the students who responded to the survey were above freshman age. It is likely that many students took courses in more than one school year which resulted in a reported average experience level near three courses per student. The fact that the FLVS students reporting here had taken an average of nearly three online courses during their high school years may indicate that students had a quality learning experience in their first course and were likely to return for further courses in this venue. If students were not satisfied with their learning experience, few would enroll for a second, third or even higher number course since FLVS courses are not required but strictly an option for students who want to take them.

The participants in this survey were normally distributed in regards to age from about age 13 to age 18 with the modal age of 16. There was no significant relationship between age and the students' perception of teachers' use of tools to enhance learning or motivation score. It may be safe to assume that students taking high school online courses can be communicated with in similar ways by teachers using digital tools to assist in the students' learning without regard to choosing one specific tool or another because of their age. There was no evidence, for example, that email worked better with younger students while IM was more efficient for older students.

In this study it was found that there was no significant relationship between males' and females' perception of teachers' use of digital communication tools. Neither was there a significant relationship between males and females in their motivation scores for working in an online environment. Of the 265 respondents who reported their gender,

171 or 65% were female while 94 or 35% were male. This corresponds closely with FLVS's reported mix of 60% female and 40% male (FLVS School Data, 2007) of the general population of the school. Both male and female students are taking advantage of the online opportunities they have at the high school level via FLVS so educators interested in creating online learning opportunities in the future probably do not need to be concerned with allowing for differences of communication styles between the genders. Various gender differences were a concern for early computer users as Barrett and Lally reported in 1999 but later researchers have found these differences to be no longer existent (Colley & Comber, 2003; Enoch & Stoker, 2006; McCoy & Heafner, 2004, Shin, 2006).

Part of the purpose of creating the Florida Virtual School was to provide opportunities for students in rural areas that would otherwise not have been available to them. As provided by the Florida Legislature, priority for placement in courses is given to students in low-performing public schools, rural schools, and high-minority schools (FLVS Placement Priority Policy, 2007). The demographic data collected in this survey shows that 18% of the sample participants were students from rural areas while 61% were from suburban areas and 20% were from urban areas of the state. The state of Florida has 11% of the population living in rural areas (U.S. Census Bureau, 2007). The data revealed that FLVS has almost double the percentage of rural students as those in the general population. This may indicate that the legislative mandate of reaching rural students is being achieved. Future online educators, both at FLVS where rural students are being specifically targeted and at any school that works with rural students, should be

aware that students in rural areas are interested in educational opportunities afforded through use of the Internet.

There was no significant relationship found between students' perception of teachers' use of tools to enhance learning, or motivation score, and the area where a student lives (rural, suburban, urban). This means that in addition to rural students being able to be helped by the offerings of online learning initiatives, suburban and urban students are equally motivated to participate in online educational opportunities.

Students were asked to self-report their current grade in the course. The reported grades were heavily skewed toward A and B. Several reasons for this may exist. One possible reason is that students taking FLVS courses are allowed to resubmit work that does not meet their own grade expectations on the first submission (J. Young, personal communication, September 27, 2006). This emphasis on mastery of content is designed to allow students to be able perform well on their tests which may result in higher grades. Another possible reason the grades are skewed towards the high side is that FLVS students are given a "grace period" in which they may try out the course and withdraw without penalty if they find they are not being successful. This policy naturally eliminates some of the lower grades that students might receive were they forced to complete any course they attempted. A third possible reason for the self-reported grades to be skewed towards A's and B's could be the fact that students may not be realistic about how they are doing in a course if it is not up to their expectations. Another plausible theory would be that the better students were more likely to participate in the study since participation was voluntary. There was no correlation found between grade in the course and either the students' perception of teachers' use of tools to enhance learning or motivation score.

This may have been caused by the low number of low grades reported. Only one grade of F, one grade of D, and 17 grades of C were reported. The remaining 93% of the 261 students who reported their grade had a grade of A or B. Thus there was insufficient variation in the data to determine if low performing students were not communicating with their teachers, or had a low level of motivation. More research needs to be done to determine if students who were not performing well in the course would make different choices of which tool would be most helpful.

Students were able to choose from among the following reasons for taking an online course with FLVS:

1. free up schedule at traditional school for other courses,
2. chance to get ahead,
3. previously failed the course or desire grade improvement,
4. wanted to take an Advance Placement course,
5. homebound or unable to attend school for health reasons, and
6. other.

There was no significant correlation between choices made and either students' perception of teachers' use of tools to enhance learning or motivation score. One-third of the students chose the first choice but almost as many, 30%, chose "other", so there are a multitude of reasons why students enroll in an online course. The high number of students who wanted to free up their schedule at their traditional school may indicate that students who are curious about a number of areas of study, are already highly motivated, and are willing to try new things, make up a sizeable percentage of the FLVS student population.

During the 2005 – 2006 school year, Florida Virtual School began offering a full middle-school program but since this program had just begun, the majority of the students in the school population as well as in the sample surveyed were high school students. No significant differences between students of different grade levels were found for either the students' perception of teachers' use of tools to enhance learning or motivation score. This indicates that teachers can make similar use of digital communication tools regardless of the grade level. Although there are many differences that can be observed between students of age 11 who are entering middle school, and students of age 18 who are completing high school, the responses received from participants in this study did not show that the age differences needed to be adjusted for when teachers are planning ways to communicate with online students.

The survey matched closely to the published FLVS school wide demographics for public, private, or home school settings. These include 71% public school students, 7% private school students and 22% home school students (FLVS School Data, 2006). No significant relationships were found between students in these three different types of schools in either the students' perception teacher's use of tools to enhance learning or motivation score.

In an effort to determine if online teachers should communicate differently with students of different ethnic backgrounds, correlations were conducted as with the other demographic variables. No significant relationships were found between students in the different ethnic groups in either the students' perception of teacher's use of tools to enhance learning or motivation score.

The findings of this research study can inform teachers that frequency and quality of their communication with students is more important than the ethnic background or almost any of the other demographic variables. One item that should be considered is number of FLVS courses taken. It was found that students who had taken multiple online courses with FLVS scored significantly higher on the motivation score scale than those who were in their first or second course. This shows that taking one course successfully may lead to others being taken by that same student which points out the importance of teachers' using the available digital communication tools to their best advantage in motivating students, building self-efficacy, and addressing the affective domain.

This study also found that the frequency of communication between teacher and student corresponds significantly with a high student motivation. It has been shown that teachers of online courses should make every effort to maintain a high level of interaction with their students if they are to use the best known practices for distance learning.

Related Further Research

The digital communication tools selected for this research were chosen because they were commonly used in online courses (including those courses taught by the Florida Virtual School) at the time the data was collected. As new technologies emerge, research on newer ways that students and teachers might communicate will need to be conducted. A tool may be designed to take advantage of innovative new technology, but that does not guarantee that it will be more helpful to student learning than ones we already have. For example, the telephone is considered by students to be one of the most helpful communication tools even though it involves some of the oldest technology of all

the tools examined. Each of these technologies evolves and changes with new products which are introduced to the education market. The Web sites available at the time of this study are much different than those of a decade earlier. They have moved from simple text and graphics to more interactive features such as immediate feedback to students' answers to questions and video streaming to deliver content in a more appealing and informative way. With the growth of content available on the Internet, websites can now provide links that direct students to a wider variety of information. Whiteboard, chat and IM are constantly improving, and even the venerable telephone has undergone drastic changes from the days of copper wires strung from house to house. All of these factors insure that research in the area of online learning will continue to be a need. Since different educational systems have widely varying levels of technology usage, research done on tools that are being used today may be useful far into the future both in an instructive capacity as well as in comparison with newer tools that evolve. Some examples of needed future research in the field are included here.

1. One significant finding of this research was the fact that the number of courses taken and motivation score were correlated. Those students having taken more courses showed a higher motivation score. This may indicate one of two things. Either students who have taken a number of courses with FLVS have had an increase in the level of their motivation, or students who are naturally highly motivated tend to take multiple courses with FLVS. Since we know that correlation between the variables does not show the direction of the effect, further research in this area may be able to determine cause and effect.

2. Future research should consider ways to measure the quality of discussions in various courses and compare this with ratings that students, teachers, and researchers give to each. Studies could also be done to make comparisons for different age groups who might vary in their perception of the importance of discussion to their learning. As more courses are available online for middle school and high school students, this research need is increased because much of the existent body of research is based on college students and adults with age not usually being a consideration of the researchers.
3. Due to very recent improvements in online whiteboard technologies and the ability for larger numbers of students and teachers to use these simultaneously, the use of additional research in how whiteboard software can be used to communicate effectively with students is strongly needed. Information about how these products work and technical details abound both on the Web and in the literature, but comparisons between those courses using whiteboard software and those without this technology are scarce.
4. Although some of the other means of communication such as IM and chat are described in the literature as being popular with students (DeGennaro, 2005; Gee, 2006; Hines & Pearl, 2004;McCloskey, 2006; Pan & Sullivan, 2005; Pelowski, Frissell, Cabral, & Yu, 2005; Presnky, 2005; Texley, 2005), these were not the most favored communication tools for interaction with the teacher by participants in this study. It may be that these modes of communication are seen by the students as ways to socialize informally with friends, but the more formal modes of communication are preferable when the information exchange needs to be

accurate and have the capability to handle larger volumes of information. A study may need to be initiated to determine if IM is viewed by students as a preferred tool for peer communication and not a preferable method of communicating with their teacher. Research involving social distance and the use of various communication tools may serve to help answer questions of this type. Further study involving Instant Messaging, chat, and other types of quick message sending technologies needs to be conducted.

5. It was found in this study that the telephone was highly rated by the participants as being one of the most helpful communication tools. From the dearth of information in the literature about use of the telephone in distance learning, especially for one-on-one communication between student and teacher, one might conclude that many distance learning courses do not include frequent use of the telephone and rely more on other tools studied here such as email. Further research comparing similar online courses that do have regularly scheduled personal calls like those used at FLVS and those that courses that do not employ regular telephone use may be warranted. An investigation of the value of regular telephone discussions between teacher and student for the purpose of maintaining academic integrity would provide valuable information about this perennial concern for educations. The telephone as well as email and assignment feedback were found to be the most commonly used tools which makes them familiar to students. These same tools were also chosen by survey respondents as the most useful tools (See Figure 9 and Figure 10). Further study will be needed to make a

clearer determination if the familiarity with a specific tool corresponds with a positive perception of helpfulness.

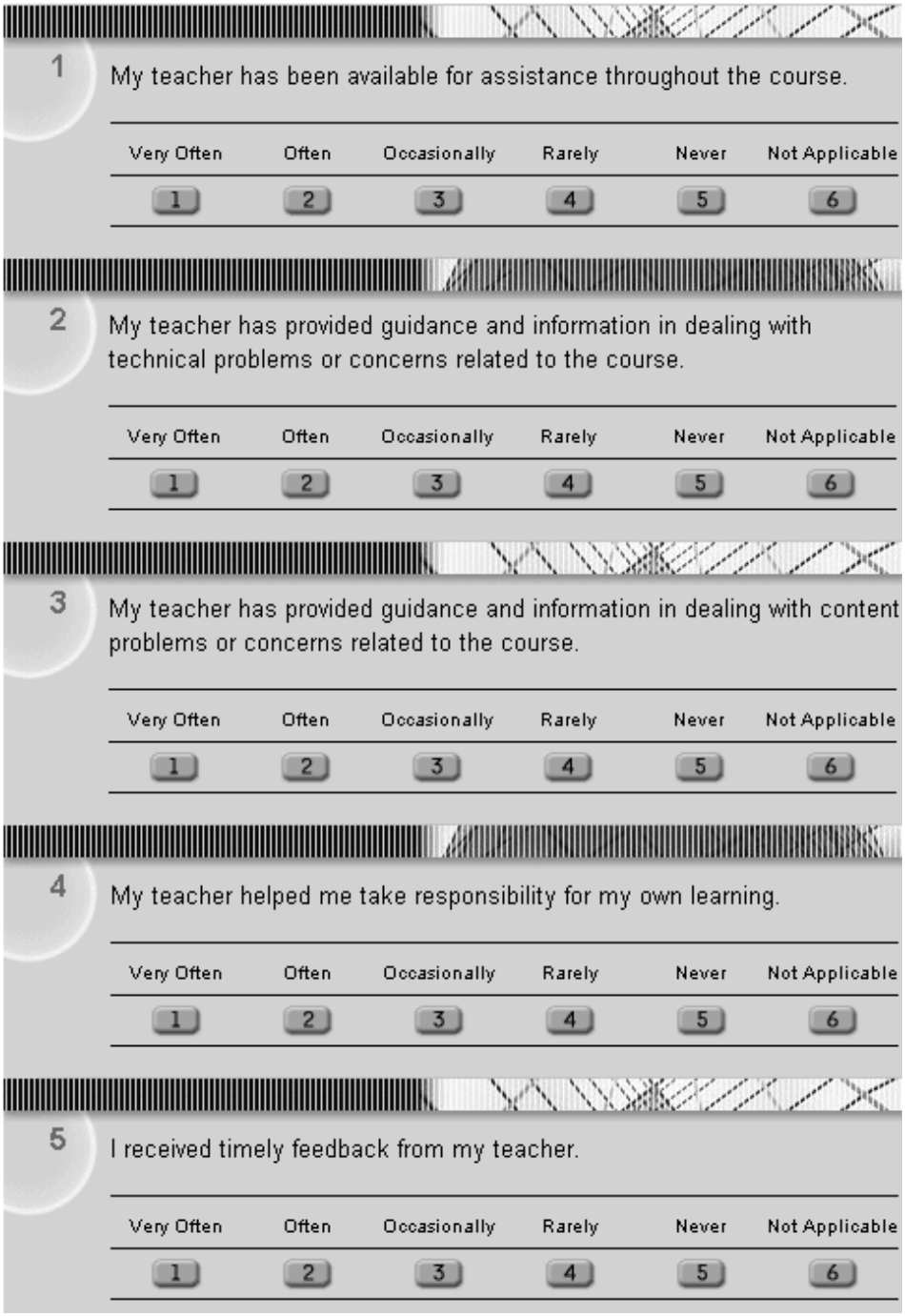
6. In this study most participants did not perceive the discussion area as being the most helpful tool in their learning. Further research needs be conducted in this area to determine the disparity between the importance placed on discussions in the literature and student views in this study regarding their helpfulness. One explanation may be that this tool was used infrequently in the courses evaluated in this study. Many questions could be asked about the types of discussion prompts that are used to stimulate student participation in discussions, the best practices in managing discussions so that students achieve optimal benefit from participating, and what amount of both student and teacher time should be allotted to discussion areas. Comparisons need to be made in a number of areas to improve our knowledge about how to best use this digital communication tool.

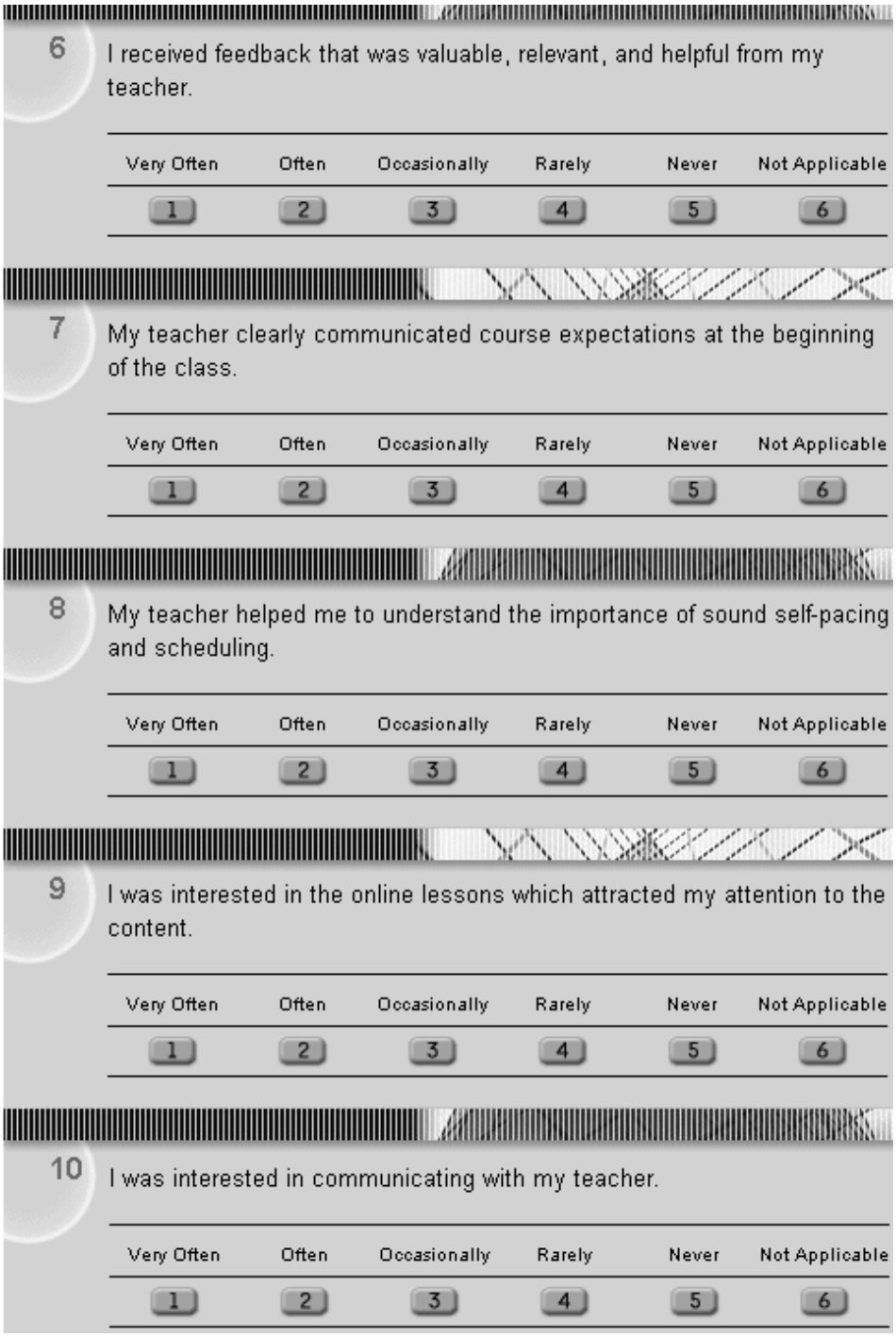
Final Conclusions

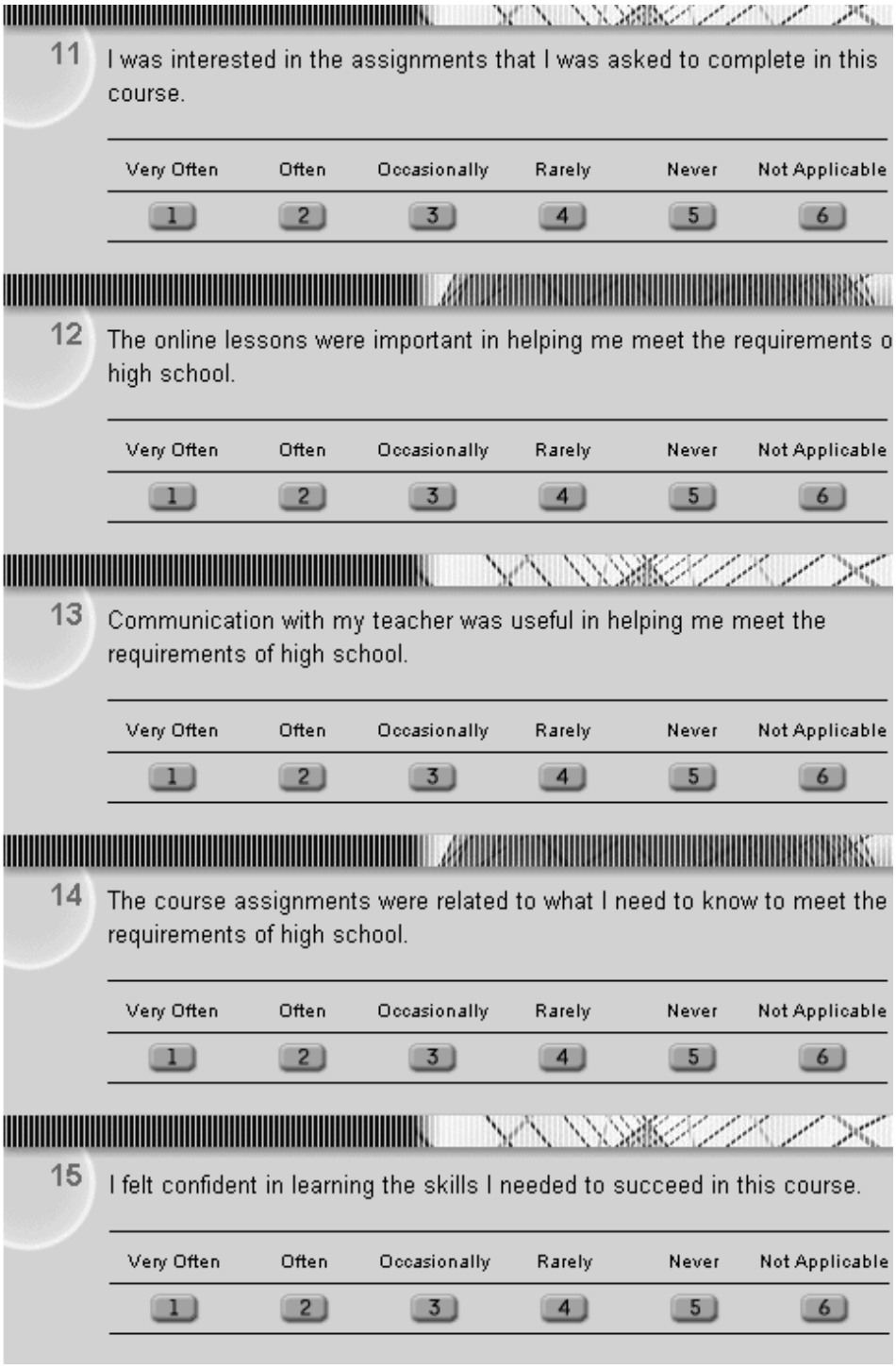
The items discussed above would involve much research to answer questions that have been raised, yet this list is inconclusive of all of the work that remains to be done in this field if we are to be able to decide from empirical evidence which are the most effective tools to use from the wide array that is available to today's online teachers. The list will continue to grow as tomorrow's teachers and are presented with an ever expanding selection of digital tools and constant evolution of the capabilities of current tools with which they can communicate with their students.

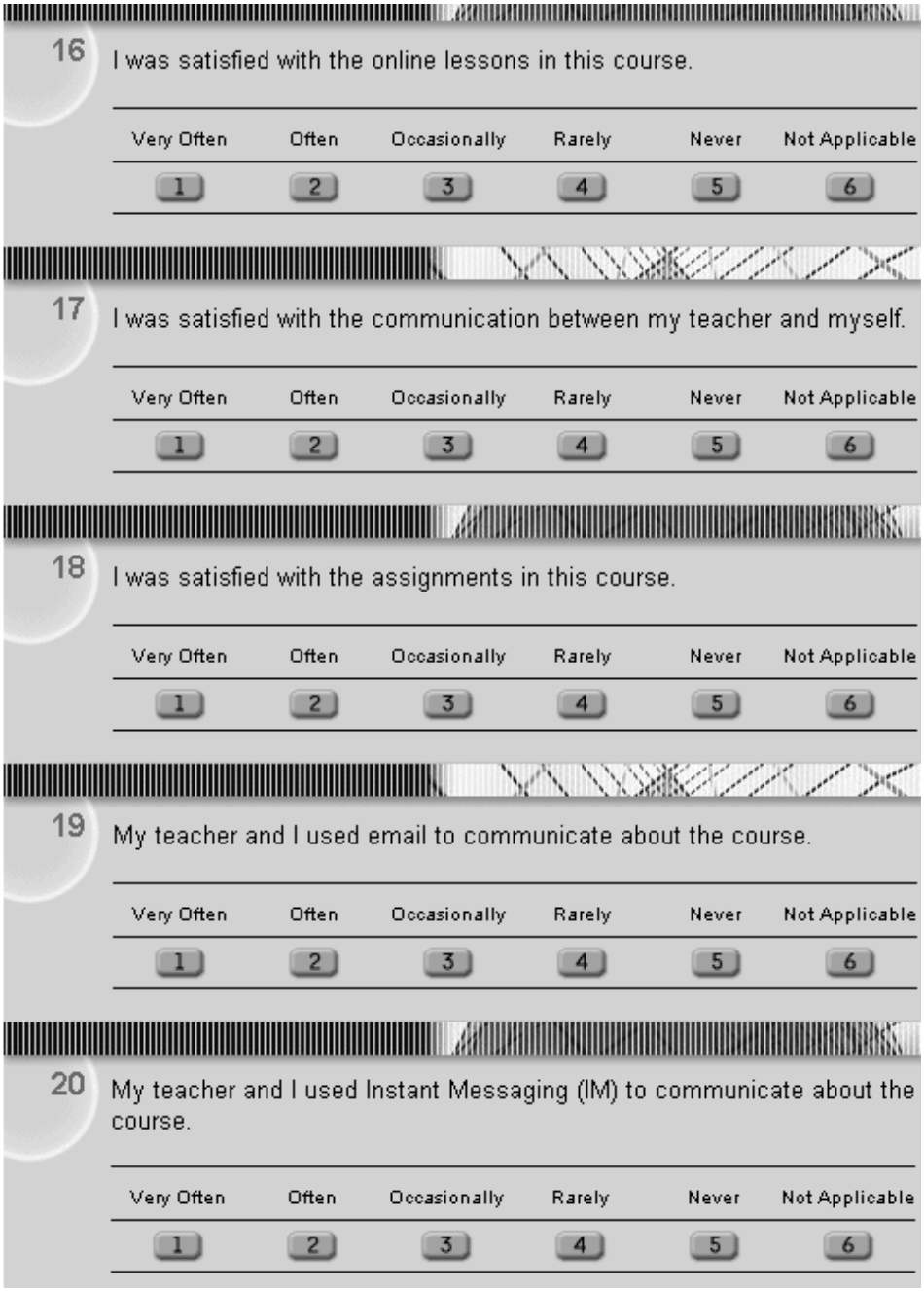
APPENDIX A: INSTRUMENT FOR MEASUREMENT OF STUDENT PERCEPTIONS ABOUT COMMUNICATION USING DIGITAL TOOLS

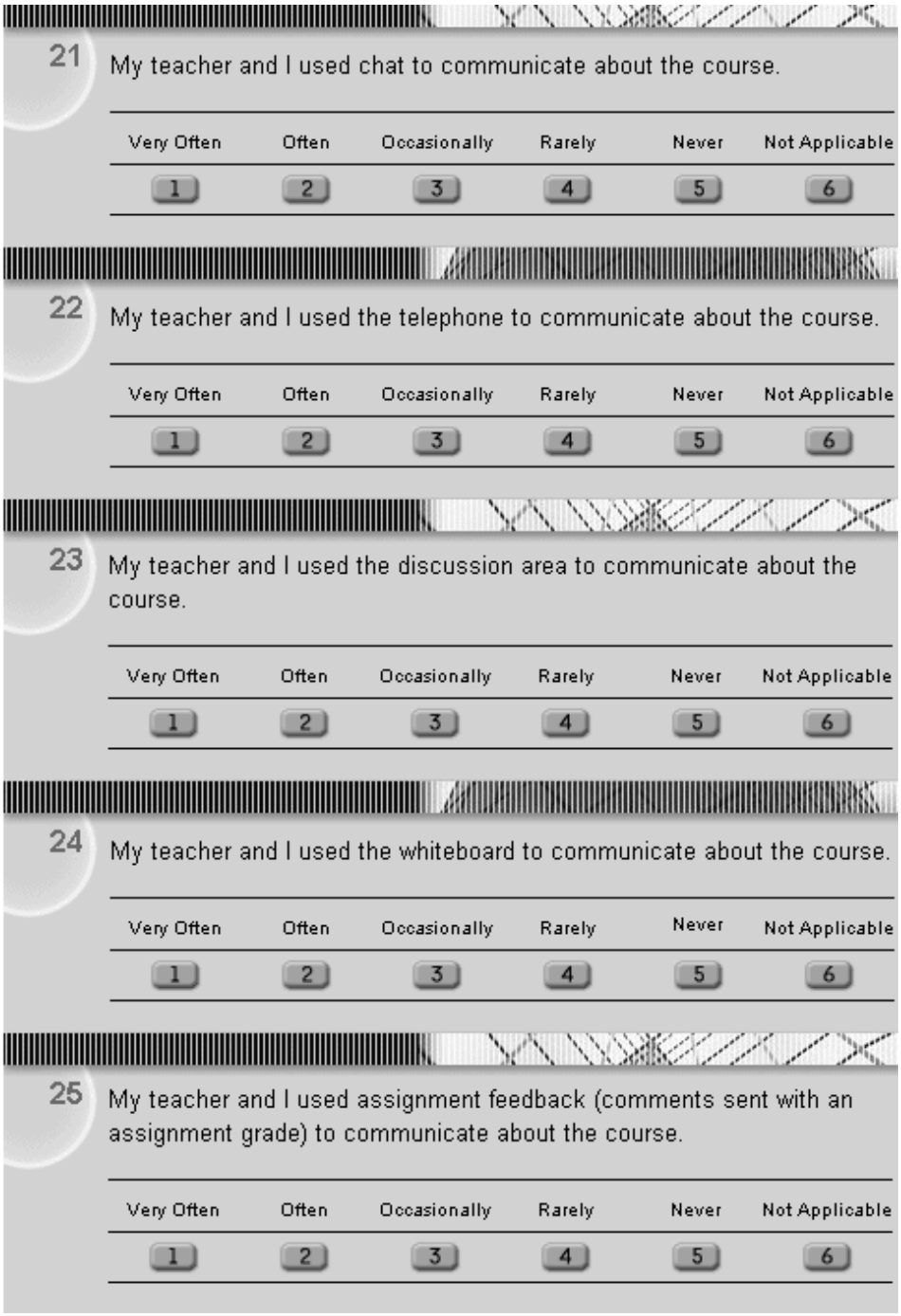
Digital Communication Tools




6
I received feedback that was valuable, relevant, and helpful from my teacher.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6
7
My teacher clearly communicated course expectations at the beginning of the class.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6
8
My teacher helped me to understand the importance of sound self-pacing and scheduling.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6
9
I was interested in the online lessons which attracted my attention to the content.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6
10
I was interested in communicating with my teacher.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6


11
I was interested in the assignments that I was asked to complete in this course.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6
12
The online lessons were important in helping me meet the requirements o high school.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6
13
Communication with my teacher was useful in helping me meet the requirements of high school.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6
14
The course assignments were related to what I need to know to meet the requirements of high school.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6
15
I felt confident in learning the skills I needed to succeed in this course.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6


16
I was satisfied with the online lessons in this course.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6
17
I was satisfied with the communication between my teacher and myself.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6
18
I was satisfied with the assignments in this course.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6
19
My teacher and I used email to communicate about the course.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6
20
My teacher and I used Instant Messaging (IM) to communicate about the course.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6


21
My teacher and I used chat to communicate about the course.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6
22
My teacher and I used the telephone to communicate about the course.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6
23
My teacher and I used the discussion area to communicate about the course.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6
24
My teacher and I used the whiteboard to communicate about the course.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6
25
My teacher and I used assignment feedback (comments sent with an assignment grade) to communicate about the course.
Very Often
Often
Occasionally
Rarely
Never
Not Applicable
1
2
3
4
5
6

26 Please indicate the type of communication that seemed most helpful to you during this course.

Email	Instant Messageing (IM)	Chat	Phone	Discussion Area	Whiteboard	Assignment Feedback (note from teacher that includes grade).
1	2	3	4	5	6	7

27 Please indicate the total number of courses you have taken online with FLVS including any in which you are now active.

1	2	3	4	5	6 or more
1	2	3	4	5	6

28 What is your age?

13 or less	14	15	16	17	18 or more
1	2	3	4	5	6

29 Please indicate your gender.

Female	Male
1	2

30 Indicate the choice that best describes the location where you live.

Rural	Suburban	Urban
1	2	3

31 Please indicate your current or final grade for the FLVS course you are using to answer these survey questions.

A	B	C	D	F
1	2	3	4	5

32 Please indicate the statement that most accurately tells why you took this course.

Free up schedule at traditional school for other courses.	Chance to get ahead.	Previously failed the course or desire grade improvement.	Wanted to take an Advanced Placement course.	Homebound or unable to attend school for health reasons.	Other
1	2	3	4	5	6

33 Please indicate your grade level in school.

6	7	8	9	10	11	12	Other
1	2	3	4	5	6	7	8

34 Indicate the choice that best describes the school where you take any other classes besides those that you are taking with FLVS.

Public School	Private School	Home School
1	2	3

35 Is this your first semester of taking online courses with FLVS?

Yes	No
1	2


36
Please indicate the choice that best describes your ethnic background.
Asian
Black
Hispanic
Native American
White
Other
1
2
3
4
5
6

APPENDIX B: COPY OF E-MAILS THAT WERE SENT TO FLORIDA VIRTUAL SCHOOL PARENTS SOLICITING A RESPONSE FROM THEIR STUDENT TO THE SURVEY FOR THIS RESEARCH

First request: Dear FLVS parent,

Congratulations on the successful participation by your child in an online course with the Florida Virtual School. You and your child are to be commended for your hard work and dedication to this point.

Since this method of learning is relatively new it is important to find out information about students' experiences in online learning so that future improvements can be made.

If you give permission and your child agrees to participate in a survey to help researchers understand more about online learning please read the following information carefully before clicking the link below. If you do not want to give permission for your child to participate in research by completing an online survey simply delete this email and no other attempt will be made to include your child's opinions in this research project.

The survey will take about 5 to 10 minutes to complete. If your child does not wish to answer any of the questions, those may be skipped. There is no expected risk or discomfort involved in taking this survey.

Once the survey is completed, the results will be private. Your child's name will not be included in the information that is submitted. The results for all of the survey information will be collected by Nathan Putney, a Florida Virtual School teacher and University of Central Florida doctoral student under the direction of Dr. Glenda A Gunter Ph.D. They will be published in a dissertation about the use of digital communication in teaching an online high school course like the one your child took or is taking.

If the student or parents have any questions about the survey please contact Mr. Putney at 239-455-3975 or nputney@flvs.net. Dr. Gunter is the Program Coordinator for Educational Technology at the University of Central Florida and may be contacted at 407-823-3502. All UCF research is reviewed by:

Institutional Review Board, University of Central Florida
Orlando Tech Center, Suite 331
Orlando, Florida 32826-3252

By allowing your child to follow the link below you are signifying that:

1. both student and parent have read all of the information above
2. the parent has given permission for the student to participate in the research
3. the student agrees to voluntarily take the survey.

Thank you for your help with this research project,
Mr. Putney
Florida Virtual School Mathematics Teacher
National Board Certified Teacher

Link to survey: http://www.

Second Request: Dear FLVS parent,

You recently received an email asking for your permission to allow your student to participate in an important survey regarding online learning. If your student has already completed the survey, thank you very much. If not, please read the remainder of this note.

Congratulations on the successful participation by your child in an online course with the Florida Virtual School. You and your child are to be commended for your hard work and dedication to this point.

Since this method of learning is relatively new it is important to find out information about students' experiences in online learning so that future improvements can be made.

If you give permission and your child agrees to participate in a survey to help researchers understand more about online learning please read the following information carefully before clicking the link below. If you do not want to give permission for your child to participate in research by completing an online survey simply delete this email and no other attempt will be made to include your child's opinions in this research project.

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1. both student and parent have read all of the information above
2. the parent has given permission for the student to participate in the research
3. the student agrees to voluntarily take the survey.

Thank you for your help with this research project,

Mr. Putney
Florida Virtual School Mathematics Teacher
National Board Certified Teacher

Link to survey: http://www.

APPENDIX C: COURSES OFFERED AT FLORIDA VIRTUAL SCHOOL

Middle School Course	Credits
Art / Visual Arts	
M/J Orientation to Art 2-D	0.5
Business Technology	
M/J Keyboarding	0.5
English	
M/J Language Arts 1	1
M/J Language Arts 2	1
M/J Language Arts 3	1
M/J Reading I	1
Foreign Language	
M/J Spanish 1	1
Mathematics	
M/J Mathematics 1	1
M/J Mathematics 2	1
M/J Mathematics 3	1
Science	
M/J Comprehensive Science 1	1
M/J Comprehensive Science 2	1
M/J Comprehensive Science 3	1
Social Studies	
M/J U. S. History (8th)	1
M/J World Cultures	1
M/J World Geography	1

High School Course	Credits
Art / Visual Arts	
Adv Pl Art History	1
Business Technology	
Business Systems and Technology	1
Web Design I	1
Web Design II	1
Computer Science	
Adv Pl Computer Science A	1
Computer Programming-Basic I	0.5
English	
Adv Pl Eng. Lang. and Composition	1
Adv Pl Eng. Lit. and Composition	1
English I	1
English II	1
English III	1
English IV	1
English|Social Studies	
American Studies	2
Foreign Language	

Chinese 1	1
Latin I	1
Latin II	1
Latin III	1
Spanish I	1
Spanish II	1
Spanish III	1
Health / Physical Education	
Adaptive Physical Education IEP or 504 Plan	0.5
Fitness Lifestyle Design	0.5
Life Management Skills	0.5
Personal Fitness	0.5
Mathematics	
Adv Pl Calculus AB	1
Algebra I	1
Algebra I A	1
Algebra I B	1
Algebra II	1
Geometry	1
Liberal Arts Mathematics	1
Pre-Calculus	1
Research and Critical Thinking	
FCAT Prep - 10th Grade Review	0.5
FCAT Prep - 8th Grade Review	0.5
SAT Preparation	0.5
Safety and Driver Education	
Driver Education/Traffic Safety	0.5
Science	
Adv Pl Biology	1
Biology I	1
Chemistry I	1
Earth-Space Science	1
Marine Science	1
Physics I	1
Social Studies	
Adv Pl Macroeconomics	0.5
Adv Pl Microeconomics	0.5
Adv Pl United States Government and Politics	0.5
Adv Pl United States History	1
American Government	0.5
American History	1
Economics	0.5
Global Studies	1
World History	1

APPENDIX D: IRB HUMAN SUBJECTS PERMISSION LETTER

University of Central Florida

Office of Research & Commercialization

November 1, 2006

Nathan Putney
675 Logan Blvd. S.
Naples, FL 34119

Dear Mr. Putney:

With reference to your protocol #06-3953 entitled, "A Descriptive Study of Digital Tools Used in Online High School Courses," I am enclosing for your records the approved, expedited document of the UCFIRB Form you had submitted to our office. **This study was approved on 10/31/06. The expiration date for this study will be 10/30/2007.** Should there be a need to extend this study, a Continuing Review form must be submitted to the IRB Office for review by the Chairman or full IRB at least one month prior to the expiration date. This is the responsibility of the investigator.

Please be advised that this approval is given for one year. Should there be any addendums or administrative changes to the already approved protocol, they must also be submitted to the Board through use of the Addendum Modification Request form. Changes should not be initiated until written IRB approval is received. Adverse events should be reported to the IRB as they occur.

Should you have any questions, please do not hesitate to call me at 407-823-2901.

Please accept our best wishes for the success of your endeavors.

Cordially,

Joanne Muratori

Joanne Muratori
UCF IRB Coordinator
(FWA00000351 Exp. 5/13/07, IRB00001138)

Copies: IRB File
Glenda Gunter, Ph.D.

JM:jm

12201 Research Parkway • Suite 501 • Orlando, FL 32826-3246 • 407-823-3778 • Fax 407-823-3299

THE UNIVERSITY OF CENTRAL FLORIDA
INSTITUTIONAL REVIEW BOARD (IRB)

IRB Committee Approval Form

PRINCIPAL INVESTIGATOR(S): **Nathan Putney** **IRB #: 06-3953**
(Supervisor: Glenda Gunter, Ph.D.)

PROJECT TITLE: A Descriptive Study of Digital Tools Used in Online High School Courses

[ ] New project submission [ ] Resubmission of lapsed project #_____
[ ] Continuing review of lapsed project #_____ [X] Continuing review of # **2941**
[X] Study expires **11/6/2006** [X] Initial submission was approved by expedited review
[ ] Initial submission was approved by full board review, but continuing review can be expedited
[ ] Suspension of enrollment email sent to PI, entered on spreadsheet, administration notified _____

Chair
[X] Expedited Approval

Dated: 10/31/06
Cite how qualifies for expedited review: minimal risk and #7

[ ] Exempt

Dated: _____
Cite how qualifies for exempt status: minimal risk and _____

[X] Expiration Date: 10/30/07

IRB Reviewers:

Signed: Tracy S. Dietz
Dr. Tracy Dietz, Chair

Signed: _____
Dr. Sophia Dziegielewski, Vice-Chair

Signed: _____
Dr. Craig Van Slyke, Vice-Chair

Complete reverse side of expedited or exempt form
[ ] Waiver of documentation of consent approved
[ ] Waiver of consent approved
[ ] Waiver of HIPAA Authorization approved

NOTES FROM IRB CHAIR (IF APPLICABLE): _____

University of Central Florida

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901, 407-882-2012 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

EXPEDITED CONTINUING REVIEW APPROVAL NOTICE

From : **UCF Institutional Review Board**
FWA00000351, Exp. 5/07/10, IRB00001138

To : **Glenda A. Gunter**

Date : **October 09, 2007**

IRB Number: **SBE-06-03953**

Study Title: **A Descriptive Study of Digital Tools Used in Online High School Courses**

Dear Researcher,

This letter serves to notify you that the continuing review application for the above study was reviewed and approved by the IRB Chair on **10/9/2007** through the expedited review process according to 45 CFR 46 (and/or 21 CFR 50/56 if FDA-regulated).

Continuation of this study has been approved for a one-year period. The expiration date is 10/08/2008. This study was determined to be no more than minimal risk and the category for which this study qualified for expedited review is:

7. Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

All data must be retained in a locked file cabinet for a minimum of three years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained on a password-protected computer if electronic information is used. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

To continue this research beyond the expiration date, a Continuing Review Form must be submitted 2 – 4 weeks prior to the expiration date. Use the Unanticipated Problem Report Form or the Serious Adverse Event Form (within 5 working days of event or knowledge of event) to report problems or events to the IRB. Do not make changes to the study (i.e., protocol methodology, consent form, personnel, site, etc.) before obtaining IRB approval. Changes can be submitted for IRB review using the Addendum/Modification Request Form. An Addendum/Modification Request Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at https://iris.research.ucf.edu .

On behalf of Tracy Dietz, Ph.D., UCF IRB Chair, this letter is signed by:

Signature applied by Janice Turchin on 10/09/2007 03:44:32 PM EDT

Janice M Turchin

IRB Coordinator

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