IMPACTS OF LEARNING STYLES AND COMPUTER SKILLS ON ADULT STUDENTS' LEARNING ONLINE

Salih RAKAP

Department of Special Education, College of Education, University of Florida, 1403 Norman Hall PO Box 117050, Gainesville, FL, 32611-7050, USA

srakaptr@gmail.com,

ABSTRACT
This study investigated the influences of learning styles/preferences, prior computer skills and experience with online courses on adult learners' knowledge acquisition in a web-based special education course. Forty-six adult learners who enrolled in a web-based special education course participated in the study. The results of the study showed that (a) learning styles/preferences had significant effects on adult students' knowledge acquisition, and (b) there is a moderate positive correlation between computer skills and students' success. Data analysis also showed that there is no relationship between prior experiences with online courses and success in a web-based course.
Keywords: Web-based learning, learning styles, computer skills, adult learners

INTRODUCTION
Providing valuable and effective professional development opportunities to in-service teachers is a long-lasting challenge for the field of education (Blackhurst, Hales, & Lahm, 1998). The growth of knowledge, practices, and technology especially in the field of special education and particularly in the area of autism has been rapid. Many teachers and other related service providers often find that their knowledge, skills and practices are not compatible with the current research-supported, evidence based practices and in need of professional development (Ludlow, Foshay, Brannan, Duff, & Dennison, 2002). However, many professionals, especially the ones living in rural areas, have little opportunity to travel to higher education institutions to take courses to upgrade their knowledge, skills and practices. One answer to this challenge is the design and implementation of web-based education and training programs related to special education (Blackhurst et al., 1998). Web based instruction is convenient and flexible, and as such, ideally suited for in-service teachers without access to higher education institutions. It also makes the teaching and learning possible any time and in any place (Steinweg, Davis, & Thomson, 2005; O'Neal, Jones, Miller, Campbell, & Pierce, 2007). Although web-based courses and programs have opened new avenues for many professionals to update their knowledge, in order to be effective, this type of course delivery requires a careful planning in terms of instructional design, learning activities and materials.

Much of the research in special education investigating the effectiveness of web-based courses has focused on either learners' satisfaction and perceptions (Beard & Harper, 2002; Ludlow et al., 2002; Spooner, Jordan, Algozzine, & Spooner, 1999) or the comparison of web-based courses with traditional face-to-face courses based on grade, satisfaction, and instructor evaluation (Caywood & Duckett, 2003; Pindiprolu, Paterson, Rule, & Lignugaris/Kraft, 2003; Steinweg et al., 2005; O'Neal et al., 2007). The findings of the research investigating the outcomes of web-based instruction in the area of special education are positive and suggest that participants of web-based courses like the course format. The studies comparing on-campus and distance education found no difference between two methods in terms of student achievement, satisfaction and instructor evaluation. Although many researchers and educators have long acknowledged and supported the concept that personal differences play an important role in learning and academic achievement (Kim & Michael, 1995; Moallem, 2007; Zhang, 2002), the research addressing web-based courses and their effectiveness in special education has not paid much attention to these differences. These individual differences, in the case of online learning, include but not limited to differences on learning styles/preferences, prior experience with online courses, self-regulation, and computer literacy (Miller & Miller, 2000).
Purpose of the Study

The main purpose of the current research, therefore, was to investigate the influences of individual learning styles/preferences and prior computer skills on adult learners' knowledge acquisition in an online text-based special education course. The research questions for this study were as follows:

1. How do individual learning styles/preferences influence adult learners' knowledge acquisition in a web-based special education course?
2. What is the relationship between adult learners' computer skills and learning in a web-based special education course?
3. Is there any difference on student success based on prior experience with web-based courses?

Learning Styles

There has been a growing body of research investigating web-based instruction and its various aspects. However, the characteristics of learners who enroll in online programs have not been investigated extensively (Kelly & Schorger, 2002; Liu, 2007; Saba, 2000). Moreover, the relationship between web-based learning and learning styles of individuals who enroll in online courses has received little attention in the literature (Harris, Dwyer, & Leeming, 2003). However, many researchers stated that in order to provide appropriate learning opportunities to students, improve their motivation and maximize their learning in web-based courses, it is important to identify their learning styles and adapt teaching methods that meet the diverse needs of learners (Drennan, Kennedy, & Pisarki, 2005; Hawk & Shah, 2007; Johnson, 2004; Wehrwein, Lujan, & DiCarlo, 2007). Research investigating the learning styles has mainly focused on comparing learning preferences of students who enrolled to online and traditional courses and their academic achievement (Aragon, Johnson, & Shaik, 2000; Buerk, Malmstrom, & Peppers, 2003; Downing & Chim, 2004; Garland, 2003; Halsne & Gatta, 2002; Liu, 2007; Manochehri & Young, 2006). The result of these studies is non-conclusive. Only in two studies, the researchers examined the relationship between learning styles and academic performance. Bozionelos (1997) reported that students with a particular learning style (i.e., active experimentation model) performed better than their classmates with other learning preferences in an online course. Harris et al. (2003) found that individual learning styles did not influence students' mean test scores. However, participants of these studies were either undergraduate or graduate students and there is no study found in the literature that focused on examining the relationship between adult students' learning preferences and academic achievement in online courses.

Many different learning styles/preferences and definitions of learning styles exist in the literature. Keefe (1979) defines learning styles as typical psychological, cognitive and affective behaviors that serve as reasonably stable indicators of how individuals perceive, respond to and interact with learning environments. Reid (1995) characterizes learning style as favored ways of taking in, processing and maintaining new information and skills. Fleming (2001) defines learning style as "an individual's preferred ways of gathering, organizing, and thinking about information (p.1). As parallel with variation on its definition, there are many different methods for assessing learners learning styles. One of the commonly used learning style/preference inventory, the VARK Questionnaire (Fleming, 2001), is used in the current study. VARK stands for visual (V), aural (A), read/write (R) and kinesthetic (K) learning preferences. Learners with visual learning preference learn best by observing, watching and seeing. Aural learners learn through listening, discussing and talking. Read/Write type learners learn best by interacting with textual materials. Learners with kinesthetic learning preference learn best by doing. Table 1 provides the learning activities offered by Fleming (2001) to support each learning style. Additional information about the VARK Questionnaire is provided in the Methods section.

Table 1: Learning activities to support each VARK learning style

Visual	Aural	Read/Write	Kinesthetic
Pictures	Discussions with	Textbook	Hands-on experiences
Posters	teacher/ peer	Readings/ Articles	Modeling
Slides	Debates	Handouts/ Notes	Role play
Videos	Arguments	Written feedback	Physical activities
Flow charts	Audio	Manuals	Guest lecturers
Different color/font	Video	Essays	Real-life experiences
Textbooks with	Music	Bibliographies	Demonstrations
diagrams/pictures	Seminars	Dictionaries	
Graphs		Glossaries	

Source: www.vark-learn.com

Computer Skills

Computer skills and comfort with different technological applications are considered essential components of student success when the courses are offered online (Erlich, Erlich-Philip, & Gal-Ezer, 2005; Jameson & McDonnell, 2007; Martz & Reddy, 2005, Shih, Munoz, & Sanchez, 2006; Summers, Waigandt, & Whittaker, 2005). However, several researchers have claimed that computer skills have little or no impact on student success and participation (McIsaac, Blocker, Mahes, & Vrasidas, 1999; Rumprapid, 1999). Since the results of these researchers is not convincing, there is a need for further investigation of this relationship. In addition, these studies have been conducted with either college or graduate student and no previous research examining the relationship between adult learners' computer skills and knowledge acquisition is identified in the literature.

Course Format
The Department of Special Education in a southeastern university has been offering a series of courses that upon completion will allow special education teachers to obtain the Autism Endorsement through the state's teacher certification office. The series consists of 4 web-based courses Teachers who participate in the project complete online program in one year.

The present study was conducted in their first semester in the program when students took a course focusing on intervention techniques to support communication and social development of students with autism in the Summer 2008 semester. This course was designed to prepare educators to understand the communication and social skills of individuals with autism. The focus of the course was on the classroom-based strategies for promoting effective communication through the use of assistive technology and augmentative and alternative communication. The course was delivered asynchronously and utilized a text-based format.

The course consisted of six modules. One topic in each module was introduced and covered each week. The objectives of the module, an introduction and a power point presentation were provided at the beginning of each module. Students were assigned readings, given a quiz and an assignment in each module. The assignments provided students with the opportunities to apply the knowledge they acquired through readings, class presentations and discussions. The students also participated in threaded discussions related to the module. Threaded discussions were asynchronous and available 24 hours per day during the module periods. These discussions provided students with opportunities to interact with each other and the instructor. The instructor developed at least one activity or course material to address different needs of each learner. The course model and delivery of instruction is illustrated in Figure 1.
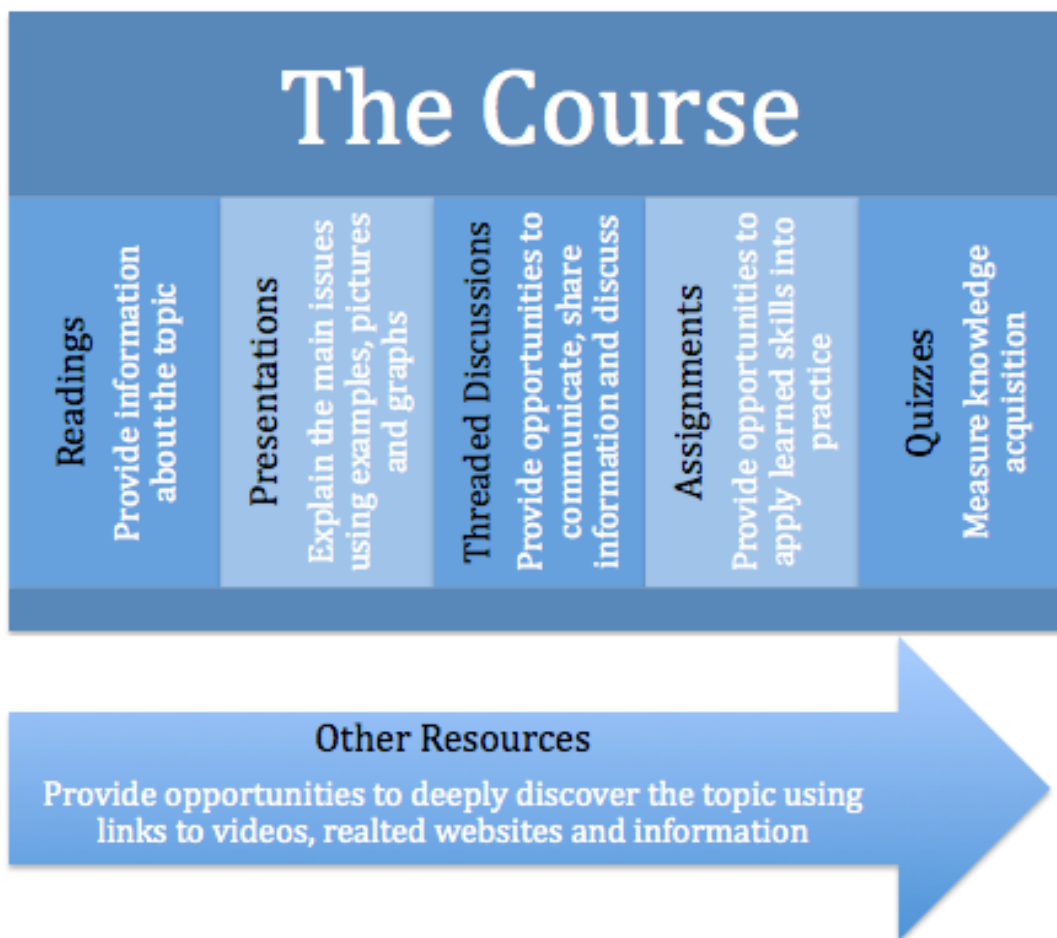

Figure 1. The course model and delivery of instruction

METHODS

Participants

Following their acceptance into the program, registered students were asked to complete consent forms and a background information form if they agreed to participate in the current study. As a result, a total of 46 students agreed to participate in this study. Participants' demographic information and information regarding their computer skills is presented in Table 2.

Table 2: Demographic Characteristics of Participants

Demographic Variables	n	%	Demographic Variables	n	%
Learning Styles			Computer Skills		
Visual	2	4.3	None	4	8.6
Aural	11	24.0	Some	8	17.4
Read/Write	15	32.6	Average	13	28.3
Kinesthetic	12	26.1	Good	10	21.7
Multimodal	6	13.0	Advanced	11	24.0
Online Course Experience			Gender		
No prior course	20	43.5	Male	2	4.3
Prior course taken	26	56.5	Female	44	95.7
Age			Ethnicity		
20-30	9	19.6	African American	2	4.3
31-40	13	28.3	Caucasian	38	82.7
40-50	14	30.4	Hispanic	6	13.0
50+	10	21.7			
Total for each Variable	46	100	Total for each Variable	46	100

Instruments

Instruments used in this study include a background information survey, the VARK questionnaire, and Self-Evaluation of Technology Use survey.

Evaluation of learning styles: The VARK learning preference questionnaire was selected to evaluate learning preference of adult students because it is very easy and quick to complete and available online. The VARK includes 13 multiple-choice questions to examine four different modalities (i.e., Visual, Aural, Read/Write, and Kinesthetic). In each question, respondents are placed in a real life learning situation, offered four options and asked to choose option(s) which best characterizes their way of learning. Respondents are allowed to choose more than one option if necessary or omit a question if no responses apply. As a result of evaluation of an individual's responses to the questionnaire, a person might have a single learning preference known as uni-modal, or more than one learning preference known as multimodal (see Figure 2 for conceptual model). Subcategories of multimodal learning preference include bi-modal (having two learning preference) tri-modal (having three learning preference) or quad-modal (having four learning preference).
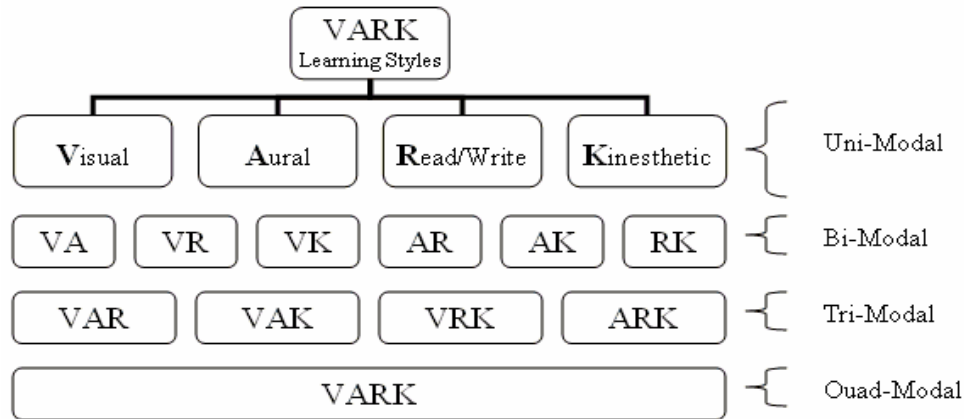
Figure 2. Conceptual Model

Evaluation of computer use, knowledge and skills. Self-Evaluation of Technology Use survey is used to measure participants' computer use, knowledge and skills prior to the course. In this survey, participants were asked to evaluate their skills on some technology tools (e.g. internet search, word processing, e-mail, electronic library etc.) and asked about their prior experience on distance education and web-based courses.

Evaluation of student learning. Students' knowledge acquisition was evaluated using the results of six quizzes that they took throughout the semester. Students were allowed to retake the quizzes if they want to improve their grades. In this study, each student's initial quiz scores were used.

Procedures
Following their acceptance into the program, a consent form along with the background information form was sent to the students. Students who returned a signed consent form to the researcher received a survey package one week before the semester began. This package included the VARK Learning Style Questionnaire and Self-Evaluation of Technology Use. Participants were given one week to complete and return the survey package to the researcher. Quiz scores of participants were obtained from the course instructor.
Analysis and Results

The Statistical Package for the Social Science (SPSS) version 15.0 is used to enter, store and analyze the data. First, data were analyzed at descriptive level. Second, group means for independent variables (i.e., learning styles, computer skill and prior online course experience) are calculated using student success (i.e., sum of quiz scores) as dependent variable (see Table 3 for details). Third, a series of t-test and one-way analysis of variance (ANOVA) test is conducted to investigate if the differences between the group means are statistically significant. For the ANOVA test that calculated a significant difference between the group means, the Post Hoc Tukey HSD analysis, a follow-up procedure, is conducted to determine where the statistically significant differences are. Finally, a correlation analysis is conducted to examine the relationship between students' computer skill and success. In the next section, the results of the analyses are presented by each research question.

Table 3: Mean Quiz Scores and Standard Deviations for Each Independent Variable

Learning Style	N	Mean	Std. D.
Visual	2	53.000	4.242
Aural	11	48.454	7.339
Read/Write	15	55.133	6.151
Kinesthetic	12	42.250	6.224
Multimodal	6	53.333	3.614
Perceived Computer Skills			
None	4	43.500	7.724
Some	8	46.875	8.741
Average	13	49.153	7.057
Good	10	49.200	8.377
Advanced	11	55.727	4.880

Prior Online Course Experience			
No prior course	20	48.800	8.088
Prior course taken	26	50.653	7.802
Total	46	49.847	7.893

Research Question 1

The first research question investigated influences of learning styles on students' success. Findings revealed that students with read/write learning preference showed the highest level of performance in the quizzes *(M=55.133, SD=6.151)* while students with kinesthetic learning preference had the lowest performance *(M=42.250, SD=6.224)*. Students with visual, aural and multimodal learning preferences scored in between *(Ms=53.000, 48.454, 53.333, SDs=4.242, 7.339, 3.614* respectively; see Table 3 for more information). A one-way ANOVA was conducted to investigate whether any difference in mean values exists with the factor being learning styles and the dependent variable being student success. Results revealed that the effect of learning style on student success was significant *(F(4,41)=7.963, p=0.00)*. Post hoc analyses using Tukey post hoc criterion for significance indicated that quiz scores of students with read/write learning preference is significantly higher than those with kinesthetic learning preference.

Research Question 2

Research question 2 examined the relationship between students' computer skill and their success in a web-based course. Simple comparison of the means showed that students with advanced computer skills had a higher mean score *(M=55.727, SD=4.880)* than students with less advanced computer skills (i.e., good; M=*49.200, SD=8.377*, average; M=*49.153, SD=7.057*, some; M=*46.875, SD=8.741*; and no computer skills; M=*43.500, SD=7.72*). See Table 3 for more information. A Spearman rank correlation was conducted to investigate the relationship between perceived computer skills (independent variable) and the student success (dependent variable). The result of the correlation analysis was statistically significant with *r=.462, p=0.01, df=44*. The correlation between two variables seems to be a moderate positive correlation.

Research Question 3

Research question 3 investigated the influences of prior experience with web-based course on student success. Students with prior web-based course experience performed slightly better *(M=50.653, SD=7.802)* students who had no prior experience with web-based learning. However, the result of independent sample t-test analysis showed that the mean difference between two variables is not statistically significant *(F=-.786, p=.436, df=44)*. Discussion

This study aimed to investigate the impacts of learning styles, computer skills and prior experience with online courses on student success in a web-based special education course. The current study has two important findings. First, the results of the data analysis demonstrated a significant effect of learning style on adult students' knowledge gain. Although the instructor of the course developed activities to support learning of students with different learning styles (e.g., discussion, hands-on assignments, presentations etc.), students with read/write learning preference outperformed students with other type of learning styles (i.e., visual, aural, and kinesthetic) in terms of academic success. Students with kinesthetic learning preference scored notably lower than classmates with other learning styles in the quizzes. This finding is consistent with earlier research findings (Bozionelos, 1997; Manochehri & Young, 2006). Second, there was found a positive correlation between students' computer skills and knowledge gain. That means that when students' computer skills increase, their success in web-based courses increase. In other words, students with more advanced computer skills score higher on the quizzes than students with less advanced computer skills. This finding also supports findings of previous research reporting the significance of computer skill and comfort with computer use (Erlich, Erlich-Philip, & Gal-Ezer, 2005; Jameson & McDonnell, 2007; Summers, Waigandt, & Whittaker, 2005). In addition, it was also found that prior experience with web-based courses and distance learning has no effect on student success. That means that students who have no prior experience with web-based courses are equally successful as their peers with prior experience are.

Implications for Practice

The results of this study showed that students knowledge gain changes as a function of learning styles. Therefore, instructors teaching online courses may need to become familiar with learning styles and comfortable with a variety of teaching strategies to address needs of individuals with different learning preferences. Using videos, chat rooms, discussion boards, and creating group assignments may increase students' interaction with each other and enhance their learning. In addition, the instructor may use a variety of different assessment strategies to evaluate student learning. Instead of using only quiz and exam scores to determine academic

success, an instructor may use some other alternative ways of evaluation such as projects, assignments, participation in the discussion and chat rooms, and portfolios. Additionally, for students with low computer skills, a tutorial or a user manual explaining how to use various functions of the course website might be placed in the main page. Instructor may also provide information about how to get technological help when needed (e.g. contact information of technology support staff).

Limitations

Despite the important findings of this study, it is important to consider its limitations while using these findings. There are at least two limitations of the current study. First, academic achievement and student success is measured using quiz scores alone. That might provide an advantage for students who learn better through reading textbooks and other written materials, since questions for the quizzes were derived from these assigned written materials. The second limitation of this investigation is that some independent variable groups (e.g. visual learning preference and students with no computer skills) had only a few participants. Therefore, the calculated statistics for these groups may not represent individuals with the similar characteristics.

CONCLUSIONS

The World Wide Web continues to be a practical medium for delivering trainings, in-service education programs and undergraduate and graduate level courses, and learning. The findings of current research further support the necessity of identifying individual differences (e.g., learning styles and computer skills) of online course participants in order to optimize instructional design and strategies, maximize learning opportunities for students enrolling in online programs and courses, and address their diverse needs for learning.

REFERENCES

Aragon, S. R., Johnson, S. D., & Shaik, N. (2000, November). *The influence of learning style preferences on student success in online vs. face-to-face environments*. Paper presented at the World Conference on the WWW and Internet. San Antonio, TX.

Beard, L.A., & Harper, C. (2002). Student perceptions of online versus campus instruction. *Education, 122*, 658-663.

Blackhurst, A. E., Hales, R.M., & Lahm, E.A. (1998). Using an education server software system to deliver special education coursework via World Wide Web. *Journal of Special Education Technology, 13*, 78-98.

Bozionelos, N. (1997). Psychology of computer use: XLIV: Computer anxiety and learning style. *Perception and Motor Skills, 84*, 753-754.

Buerk, J. P., Malmstrom, T., & Peppers, E. (2003). Learning environments and learning styles: Non-traditional student enrollment and success in an Internet-based versus a lecture-based computer science course. *Learning Environments Research, 6*, 137-155.

Caywood, K.D., & Duckett, J. (2003). Online vs. on-campus learning in teacher education. *Teacher Education and Special Education, 26*, 98-105.

Downing, K., & Chim, T. M. (2004). Reflectors as online extraverts? *Educational Studies, 30*, 265-276.

Drennan, J., Kennedy, J., & Pisarki, A. (2005). Factors affecting student attitudes toward flexible online learning in management education. *The Journal of Educational Research*, 98, 331-338.

Erlich, Z., Erlich-Philip, I., & Gal-Ezer, J. (2005). Skills required for participating in CMC courses: An empirical study. *Computers & Education*, 44, 477-487.

Fleming, N. (2001). *Teaching and learning styles: VARK strategies.* Christchurch, New Zealand.

Garland, D. K. (2003). Learning style characteristics of the online student: A study of learning styles, learner engagement, and gender. *Dissertation Abstracts International Section A: Humanities and Social Sciences, 63*(12-A), 4282.

Halsne, A. M., & Gatta, L. A. (2002, Spring). Online versus traditionally-delivered instruction: A descriptive study of learner characteristics in a community college. *Online Journal of Distance Learning dministration, 5*(1), Retrieved September 19, 2008 from http://www.westga.edu/%7Edistance/ojdla/index.php.

Harris, R.N., Dwyer, W.O., & Leeming, F.C. (2003). Are learning styles relevant in Web-based instruction? *Journal of Educational Computing Research, 29*, 13-38.

Hawk, T. F., & Shah, A. J. (2007). Using learning style instruments to enhance student learning. *Decision Sciences Journal of Innovative Education*, 5, 1-19.

Jameson, J.M., & McDonnell, J. (2007). Going the distance to train teachers for students with severe disabilities: The University of Utah Distance Teacher Education Program. *Rural Special Education Quarterly, 26,* 26-32.

Johnson, L.R. (2004). Research-based online course development for special education teacher preparation. *Teacher Education and Special Education*, 27, 207-223.

Keefe, J.W. (1979). Learning style: An overview. In J. W. Keefe (Ed.), *Student learning styles: Diagnosing and prescribing programs* (pp. 1-17). Reston, VA: National Association of Secondary School Principals.

Kelly, K.L., & Schorger, J. (2002). *Online learning: Personalities, preferences and perceptions.* (ERIC Reproduction Service Number ED 470 663).

Kim, J., & Michael, W.B. (1995). The relationship of creativity measures to school achievement and preferred leaning and thinking style in a sample of Korean high school students. *Educational and Psychological Measurement*, 55, 60-71.

Liu, Y. (2007). A comparative study of learning styles between online and traditional students. *Journal of Educational Computing Research*, 37, 41-63.

Ludlow, B.L., Foshay, J.D., Brannan, S.A., Duff, M.C., & Dennison, K.E. (2002). Updating knowledge and skills of practitioners in rural areas: web based model. *Rural Special Education Quarterly, 21,* 33-44.

Manochehri, N., & Young, J.I. (2006). The impact of student learning styles with web-based learning or instructor-based learning on student knowledge and satisfaction. *The Quarterly Review of Distance Education, 7,* 313-316.

Martz, W.M., & Reddy, V.K. (2005). Success in distance education. In C. Howard, J. Boettcher, L. Justice, K. Schenk, P.L. Rogers, & G.A. Berg (Eds.), *Encyclopedia of distance education* (Vol. 3, pp. 1440-1445). Hershey, PA: Idea Group Reference.

Mclsaac, M., Blocher, J., Mahes, V., & Vrasidas, C. (1999). Student and teacher perceptions of interaction in online computer-mediated communication. *Educational Media International*, 36, 121–131.

Miller, S.M., & Miller, K.L. (2000). Theoretical and practical considerations in the design of web-based instruction (156-177). In B. Abbey (Ed.), *Instructional and cognitive impacts of web-based education.* Hershey, PA: Idea Group Publishing.

Moallem, M. (2007). Accommodating individual differences in the design of online learning environments: A comparative study. *Journal of Research on Technology in Education, 40*, 217-245.

O'Neal, K., Jones, W.P., Miller, S.P., Campbell, P., & Pierce, T. (2007). Comparing web-based to traditional instruction for teaching special education content. *Teacher Education and Special Education, 30*, 34-41.

Pindiprolu, S.S., Peterson, S.M., Rule, S., & Lignugaris-Kraft, B. (2003). Using web-mediated experiential case-based instruction to teach functional behavioral assessment skills. *Teacher Education and Special Education, 26*, 1-16.

Reid, J. (1995). *Learning styles in the ESL/EFL classroom.* New York: Heinle & Heinle.

Rumprapid, C. (1999). An evaluation of the effect of user interface elements and user
learning styles on user performance, confidence, and satisfaction on the World Wide Web. *Dissertation Abstracts International, 60,* 10A. (ERIC Document Reproduction Service No. ADG 9918516).

Saba, F. (2000). Research in distance education: A status report. *International Review of Research in Open and Distance Learning(Online),* 1(1), 1-9. Retrieved September 19, 2008, from http://www.irrodl.org/index.php/irrodl/article/view/4/24.

Shih, P., Munoz, D., & Sanchez, F. (2006). The effect of previous experience with information and communication technologies on performance in a Web-based learning program. *Computers in Human Behavior, 22*, 962-970.

Spooner, F., Jordan, L., Algozzine, B., & Spooner, M. (1999). Student rating of instruction in distance learning and on-campus classes. *The Journal of Educationl Research, 92*, 132-140.

Steinweg, S.B., Davis, M.L., & Thomson, W.S. (2005). A comparison of traditional and online instruction in an introduction to special education course. *Teacher Education and Special Education, 28*, 62-73.

Summers, J.J., Waigandt, A., & Whittaker, T.A. (2005). A comparison of student achievement and satisfaction in an online versus a traditional face-to-face statistics class. *Innovative Higher Education, 29*, 233-250.

VARK. (2008). *A guide to learning styles.* Retrieved September 1, 2008 from http://www.vark-learn.com/english/index.asp

Wehrwein, E.A., Lujan, H.L., & DiCarlo, S.E. (2007). Gender differences in learning styles preferences among undergraduate physiology student. *Advanced Physiology Education, 31,* 153-157.

Zhang, L.F. (2002). Thinking styles: Their relationships with modes of thinking and academic performance. *Educational Psychology, 22,* 331-348.