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SCIENCE TEACHERS' PERCEPTIONS OF VIRTUAL HIGH SCHOOL INSTRUCTION

Abstract

This research study examined the difficulties that virtual high school science teachers encountered while teaching science online and the level of importance they placed on pedagogical skills. This study also focused on analyzing the relationship between virtual high school science teachers' perceptions of difficulties to teach science online and the level of importance they place on the pedagogical skills. A quantitative study was designed to conduct this study. A web-based survey that included 40 Likert-scaled items was prepared and sent to the participating virtual high schools along with a detailed cover letter that explained the research protocol clearly. The literature review discussed in detail the following areas: 1. Virtual high school pedagogy in terms of constructivist principles. 2. Identified Constructivism as a theoretical framework to provide a better understanding for virtual high school pedagogy. 3. Discussed the advantages and challenges in virtual high school. 4. Finally, discussed briefly Effective Teaching and Learning process in virtual high school in terms of Borich's five key behaviors and five helping behaviors that are essential for effective teaching. The results were analyzed using means, median, frequency scores and The Wilcoxon Signed-Ranks test to understand the difficulties that virtual high school science teachers encounter while teaching science online. Spearman Coefficient Correlation was calculated to determine

the relationship between the level of importance virtual high school science teachers place on pedagogical skills and their perceptions of difficulties or vice versa.

Finally, based on the results, possible recommendations for improved teaching strategies to overcome those difficulties are included in the concluding part of this study.

Introduction

Over the past decade, emerging computer technology has made available a myriad of opportunities for innovations in teaching that hardly could have been imagined a decade ago. "Since the 1960s, the use of computer technology in education has focused on means and methods to enhance the teaching process." (Tennyson & park- p.319) The rapid development of computer and Internet technology has led to the widespread use of the Internet and web sites in teaching. As a result, "the deployment and diffusion of online courses in K-12 schools and postsecondary institutions is becoming almost irresistible force." (North Central Regional Educational Laboratory (NCREL), 2002 p.1) Even though the exact magnitude of the use of the virtual classrooms as an alternative approach to the traditional classroom teaching is not known, the fact that the virtual classroom approach to teaching is on a rapid rise cannot be denied. A recent report of the National Association of State Boards of Education states that electronically delivered learning "will improve American education in valuable ways and should be universally implemented as soon as possible."(NCREL, 2002, p.1) Technological innovations such as the use of multimedia, World Wide Web have become the focal concern in secondary education bringing a shift in the education paradigm. In order to understand when the stage was set up for the adoption of virtual high schools to bring about changes in the

conduct of teaching and learning, we have to go back to 1960s when the use of computers in the field of education became a reality.

Problem Statement

Web-based Education commission (2000) states that web-based educational technology plays a critical role in bringing education to students in rural and inner-city communities and offers a broader range of courses and curriculums. Clark's (2001) report states that most state virtual high schools are committed to providing equitable access to public education and Advanced Placement courses. Their policies encourage at-risk students and rural students to participate in virtual high schools. The evaluation report on the VHS submitted during the year 1999-2000 state that "VHS students acquired the technology-based reasoning and communication skills needed for the 21st century information society." (SRI Project, 2000) The Benchmarks for science Literacy states that "Computers have become invaluable in science because they speed up and extend people's ability to collect, store, compile, and analyze data, prepare research reports, and share data and ideas with investigators over the world." (American Association for the Advancement of Science, 1993, p.18) The latest science education standards also state that "Instructional technology provides students and teachers with exiting tools-such as computers-to conduct inquiry and to understand science." (National Research Council, 1996, p.24) Russer ('96) perceives computers as personal electronic teachers and intelligent teaching systems with the vision of computer as the "future dominant delivery system in education for almost all age levels and in most subject areas" (Bork,1985, p.1 in Russer,'96) Although some research has been

conducted to document the promise that web-based teaching and learning holds for education , especially in science education to foster students' understanding of complex science concepts and facilitate their learning, there is only a small body of educational research that examined the difficulties science teachers encounter while teaching complex science concepts online. Developing innovative strategies to promote inquiry, investigation and problem-solving skills and implementing them online is a major challenge for teachers. Meeting these new technological changes require teachers to use appropriate technological tools, novel instructional techniques and strategies to make students actively participate in the process of instruction. This study examines how to make web-based teaching and learning a vehicle for effective science instruction by identifying the issues and challenges encountered by online science teachers and offering recommendations to respond to the challenges.

Rationale

Teaching science to high school students in a traditional classroom configuration does not apply to an environment where the teachers and students interact with each other only through the electronic medium. “ The transition from in-class room instruction to online instruction is a complex one involving specialized training in the technical aspects of delivering quality educational materials (or environments) to students, and specialized training in how to foster knowledge acquisition within this new environment.” (Gold, 2001 p.1) “Using effectively, this environment has the potential to level the playing field for individual differences that have historically provided obstacles to learning. However, if the student does not have the appropriate support or they are not able to regulate their learning with some amount of structure and discipline, all of these positive attributes will

transform into impassable barriers.” (Hargis, 2000 p.2) In order to provide such a support to students and also to operate effectively within an online educational environment, an online teacher has to develop a completely new understanding about the learners, the subject, and delivery of instruction, employs several types of instructional strategies that will help their students to make sense of the new learning environment. While designing instruction for the Net, the online science teachers must take into consideration a variety of factors such as: technical considerations, selection of instructional strategies, information sources, providing students with guidelines to use the resources of the Internet effectively. In order to understand the difficulties that virtual high school science teachers face to meet their instructional goals; to identify those barriers and help them improve their teaching practices; there is still a great deal of research that needs to be done. (McManus, 95). Therefore, I believe that addressing the difficulties/barriers that online science teachers encounter at an earlier stage will enable online science teachers to improve their course design, delivery techniques that will meet the needs of their online science students.

Research Questions

The major focus of this research study is to investigate online science teachers' perception of difficulties encountered while delivering instruction online. This study will utilize a questionnaire to examine specifically, virtual high school science teachers' perception of difficulties to meet their instructional goals online. The sub-questions are:

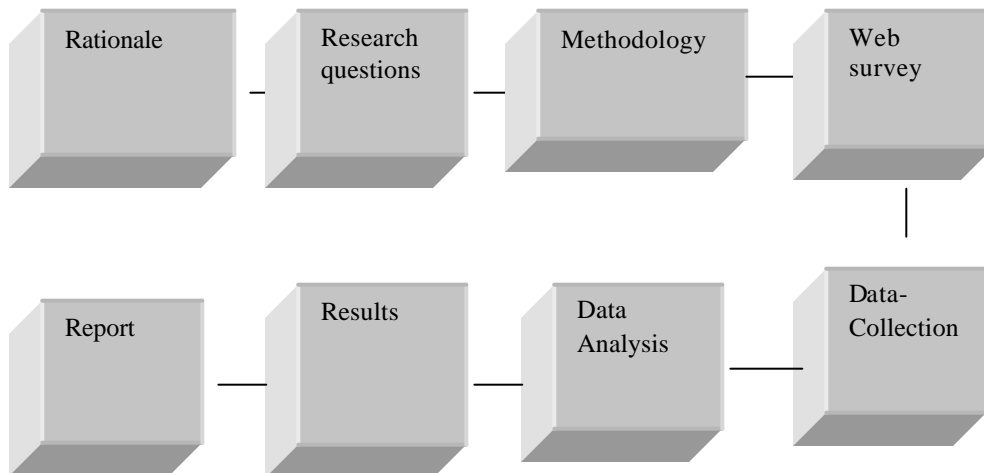
- a) What are the factors that pose difficulties for them to teach science online?
- b) What is the level of importance they place on pedagogical skills?
- c) Does the level of importance they place on pedagogical skills have any relationship on their perception of difficulties or vice versa?

Research hypotheses

The null hypotheses state:

- a) Virtual high school science teachers do not encounter any difficulties while teaching science online.
- b) Virtual high school science teachers do not place importance on pedagogical skills.
- c) There is no relationship between online science teachers' perception of difficulties to teach science online and the level of importance that they place on the pedagogical skills.

Research Plan



Research hypotheses

The null hypotheses state that a) virtual high school science teachers do not encounter any difficulties while teaching science online and b) virtual high school science teachers do not place importance on pedagogical skills c) there is no relationship between virtual

high school science teachers' perception of difficulties to teach science online and the level of importance that they place on the pedagogical skills. Based on the data and the results the hypotheses will be either supported or refuted.

Methodology

Procedure

This research study was designed to identify the difficulties that virtual high school teachers encounter while teaching science online. It also examined the relationship between virtual high school science teachers' perception of difficulties when teaching science online and the level of importance they place on pedagogical skills

Before the survey was developed, VHS Net course standards, VHS Teachers Learning conference Evaluation criteria, and several similar surveys such as the evaluation survey prepared by SRI international for The Concord Consortium, an evaluation survey prepared for the Michigan Public School Academy by The Evaluation Center, Western Michigan University and few other surveys that were retrieved from the Web were reviewed for a better understanding of a well designed survey. Identification of the virtual high schools was done by browsing the web and the participants for the study were selected from those virtual high schools. The list of the virtual high schools that have volunteered to participate in the study is provided. (See the attachment) a web-based survey that included 40 Likert-scaled items along with a detailed cover letter that explained the research protocol clearly was sent to the participating virtual high schools.

Study design

A survey instrument (Appendix B), Virtual High School Science Instruction Survey was designed to examine the following issues:

- a) The difficulties that virtual high school science teachers encounter while teaching science online.
- b) The importance that virtual high school science teachers place on pedagogical skills.
- b) The relationship between the level of difficulty that the science teachers encounter while teaching science online and the level of importance that they place on the pedagogical skills.

The survey included a few open-ended questions to get the information about the teachers' teaching background and about forty Likert-scaled items. These items were prepared to measure: a) virtual high school teachers' perception of difficulties while teaching science online and b) the level of importance they place on the pedagogical skills to teach science online. The items were organized into four main categories or set of scales such as content, teaching and learning strategies, assessment, and resources. A specialist in web-based data collection was selected to design the web-based survey. A list of e-mail addresses for the various virtual high schools that offer science courses were obtained from the schools' web pages. All the program directors were sent a formal letter that explained the research study and request for them to send the e-mail addresses of their online science teachers who were willing to participate in the study. The e-mail addresses were used to invite the online science teachers to participate in the study via an

e-mail message directing them to the web site specifically created for the collection of this data. Other than the institution's name, no information that would identify the teachers by name or location was collected.

Informed consent was obtained via the respondents accessing the web site, reading the informed consent (Appendix A) and completing the survey. Completion of the questionnaire served as consent. Confidentiality was maintained by the researcher. After the completion of this research study the data collected and other information about the participants were destroyed. Participation by the teachers was entirely voluntary and confidential.

The data were collected everyday from the website and downloaded to a personal computer. As soon as the data were collected, the information on the web site was destroyed. The data were analyzed in aggregate only and not on a case by case basis.

Data Analysis/ Result

The data were analyzed statistically using SPSS, data analysis software normally used for statistical analysis. The following statistical procedures were conducted to analyze the data: The data were analyzed using the frequencies, median scores and The Wilcoxon Signed-Ranks test to determine the difficulties that virtual high school teachers encounter while teaching science online and also the importance they place on pedagogical skills. Spearman Correlation Coefficient was used to determine how strongly the two variables are related by this measurement.

a) A two factor matrix will be developed to understand the relationship between the level of difficulty and the level of importance as well as the interaction between factor A and factor B. The analysis of Spearman- Correlation enabled the researcher to

compare these conditions (level of difficulty and the level of importance) for the differences in the variance.

		B			
		Content	T&L stra	Assessment	Resources
A	Level of difficulty				
	Level of importance				

I. H_0 level of difficulty = $\rightarrow p$ value = 0.05

H_a level of difficulty = $\leftarrow p$ value = 0.05

2. H_0 level of importance = $\rightarrow p$ value = 0.05

H_a level of importance = $\leftarrow p$ value = 0.05

The number of teachers who reported difficulty delivering science instruction online were calculated through computation of mean, median scores for each category namely content, instructional strategies, assessment, and resources and also, the percentage of teachers who have difficulty to teach science online as well as the level of importance they place on pedagogical skills for each item in these four areas were determined.

To test the third hypothesis (b) Spearman Correlation Coefficients was conducted and the scores of the reported difficulty and reported importance were compared to identify statistically significant differences in the four areas or set of scales namely the content, teaching and learning strategies, assessment and resources.

The results will be shared with the directors of the participating schools and disseminated with the rest of the community through the presentation in the conferences and publications in journals.

Significance of this research study

Based on the results, recommendations are offered for virtual high school science teachers for improved instructional strategies to overcome their perceived difficulties to teach science online. This study will serve as an initiative for designing a future research that will make virtual high school science education a successful endeavor. Further, this study will be an important contribution to the professional development in virtual high schools. Finally, this will provide an opportunity for the novice researcher, a valuable research experience.