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ABSTRACT

This study investigates the relationships among different types of resources in science and student science career interests. A survey method was used to collect data from over 600 middle school students in several states. Classrooms were classified into resources use types based on teacher responses to six questions indicating the regular use of resources during science class and were coded as: low "sociableness" and low "webnicity"; high sociableness and low webnicity; low sociableness and high webnicity; and high sociableness and high webnicity. The results of the study indicated that the regular use of human resources was a significant predictor of science career interest for both boys and girls. The use of Web resources predicted science career interest scores only for girls. Understanding these relationships can help strengthen the process of designing science education and support decision-making related to securing resources that may inspire students to pursue science. (Contains 41 references.) (AEF)

Predictive relationships among science classroom resources and middle school student interest in science careers: An exploratory analysis

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Predictive relationships among science classroom resources and middle school student interest in science careers: An exploratory analysis

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Abstract

Developing interest in specific career domains is a consequence of many learning interactions with the people, information, and objects of the practice (Lave & Wenger 1991). Instructional experiences in middle school have been shown to be predictive of persistence in the study of science in later years (Gallagher, 1994). This study was designed to investigate the relationships among the different types of resources in science and student science career interests. The results of this study indicated that the regular use of human resources was a significant predictor of science career interest for both boys and girls. The use of web resources predicted science career interest scores only for girls. Understanding these relationships can help strengthen the process of designing science education and support decision-making related to securing resources that may inspire students to pursue science.

Introduction

> Implications for future applications of technology are many ... a mature profession recognizes its needs and seeks to utilize all of the resources – human and nonhuman – that it can muster to attain its goals and objectives ... (Hayden & Torkelson 1973, p. 34).

The U.S. invests millions of dollars each year on securing and developing new resources to inspire students to pursue science. Since middle school is a time when students begin to explore careers - and select and de-select career domains to pursue (Gottfredson, 1981) - it is important to understand the relationships among the types of resources used during middle school science and the level of student interest in science careers.

Many questions remain unanswered in regard to the use of web resources in the classroom. Is regularly using information from outside the science classroom – through web resources – more predictive of students' interest in science careers than students in classrooms that do not regularly employ these types of resources?

Development of Interest: Interactions and Relationship Building

Interest, an acquired attention or enthusiasm for a particular field, is a *learned* characteristic and has been shown to be the key factor in making career choices (Super, 1984). Developing interest in a specific career domain, such as science, is a consequence of many learning interactions with the people, information, and objects – resources – of the practice. Lave & Wenger (1991) describe learning, such as developing an interest in pursuing science, not as a matter of a person's internalizing knowledge but as a matter of a person's transforming his/her participation in a social community. Learning, therefore, is based on building relationships between people and their places in the community and associations with the information and objects of the practice. Thus, becoming a member of a community of scientific practice requires that newcomers interact with the information, artifacts, and people that make up and define the scientific community.

Development of Career Interest and Classroom Variables

When children enter into adolescence and begin to develop their own career interests, people and activities outside the home and specifically in the classroom, influence them. Research investigating the relationship between rich learning environments and developing interest in science careers, especially for girls and minorities (Hill, Pettus, & Hedin, 1990; Kahle, Matyas, & Cho, 1985; Mason & Kahle, 1988), has provided evidence of the effect of some classroom variables on student interest levels. However, the research in this area often has focused on the results of sensitizing teachers to the needs of minorities and training teachers in the use of sound instructional strategies that promote career interest. It is not clear how much of a middle school student's interest in science careers can be attributed to the use of classroom resources.

Dimensions of Informational Resources

In this study types of classroom resources were classified along two dimensions - "sociableness" and "webnicity" of information. Sociableness is a measure of providing information through interactions with people (Sundar, 1994). High sociableness occurs when people, human resources, are actively and socially involved in sharing information with others in the learning environment. Webnicity (Grabowski, personal conversation on October 19, 1999) is a measure of a resource's interconnectedness of information to other supporting information on a continuum regardless of delivery methods or reference to the form of information. On one extreme, high webnicity refers to resources providing vast and easily accessible supportive information as only available on the Internet. On the other extreme, low webnicity refers to resources that provide limited supporting information that is not easily accessed in time, often classroom-bound, i.e., requiring students to leave the classroom to get additional information.

Why would Sociableness and Webnicity of Resources make a Difference?

Lent et al. (1994) weave social learning theory and self-efficacy career development frameworks together to create a career development model that interlocks the processes of interest development, choice, and performance. They argued that over the course of adolescence, being exposed to social interactions differentially reinforced the individual for pursuing certain activities from among those that were possible, thus gave rise to interests in specific career domains. Exposing early adolescents to a variety of human resources during science class could be most beneficial in fostering curiosity and exploratory behaviors that promote career interests (Super, 1984).

Studies have found that when web resources were introduced into the classroom, students interacted in more complex tasks, developed greater technical skills, and used more outside information (Hardin & Ziebarth, 1995; Owston, 1997; Rice, McBride, & John, 1998) than before the Internet was available. Resources high in webnicity provided access to additional information resources and promoted the use of additional information resources.

What is not currently understood is whether there is a significant relationship between developing career interests in science and the use of resources with different combinations of sociableness and webnicity. Unpacking the relationships between the types of supporting information resources used in the classroom and student interests may help to determine which types of resources could be used in science classrooms to inspire students to pursue of science.

Methodology

A survey method was used to collect data from over 600 middle school students in several states. Student data were collected using a modified version of the Self-Directed Search Career Explorer for Middle School students (Holland & Powell, 1994) and teacher questions drawn from research on integrating technology resources into the classroom (Grabowski & Koszalka, 1998).

Classrooms were classified into resources use types based on teacher responses to six questions indicating the *regular* use of resources during science class and were coded as:

1. Low sociableness and low webnicity
2. High sociableness and low webnicity
3. Low sociableness and high webnicity
4. High sociableness and high webnicity

A 2-level hierarchical linear model (HLM) was used to examine the associations between classroom- and student-level factors and science career interest.

Results

A total of 658 surveys, from 23 teachers in 9 schools were administered and returned (94% return rate). The surveys included 51% girls (n=304) and 49% boys (n=297).

This sample of students had a fairly high level of interest in pursuing science careers (M=23.47, SD=5.37). The scores spanned 34 points ranging from a minimum score of 2 to maximum score of 36. The distribution of scores had a slightly negative skew, -.437 indicating a slightly higher frequency of scores above the mean than below.

The mean science career interest for students in classrooms that used resources low in sociableness and low in webnicity was 17.46, for boys it was 18.10 and for girls it was 16.46. The mean score for students in classrooms that used resources low is sociableness and high in webnicity was 21.95, for boys the mean score was 20.12 and for girls it was 24.19. Students in classrooms that used resources high in sociableness and low in webnicity had a mean science career interest score of 20.68, for boys the mean score was 21.83 and for girls it was 21.52. For classrooms that used resources both high in sociableness and high in webnicity the mean science career interest score was 28.33, for boys it was 23.44 and for girls it was 29.31. (See Table 1.)

Table 1. Science Career Interest and Combinations of Sociableness and Webnicity

	All Students			Boys			Girls		
Resource Types	M	SD	N	M	SD	N	M	SD	n
Low Sociableness and Low Webnicity	17.46	6.05	68	18.10	7.55	30	16.46	4.44	37
Low Sociableness and High Webnicity	21.95	4.67	105	20.12	5.26	53	24.19	3.69	48
High Sociableness and Low Webnicity	20.68	5.74	88	21.83	5.55	46	21.52	6.01	42
High Sociableness and High Webnicity	28.33	4.66	358	23.44	4.88	168	29.31	4.50	177

Notes: Possible range for science career interest scores is 0 – 36 points; All students: n=619, mean score 23.47; Boys: n = 297, mean score 23.71; Girls: n = 304, mean score 23.12

An HLM baseline analysis of the data revealed that the average mean science career interest score across all classrooms was 23.63. The reliability measure for this data was .871, indicating that the sample means tend to be quite reliable as indicators of the true classroom means. The analysis resulted in a chi square of 196.581 with 22 degrees of freedom and a $p < .000$, indicating that there was evidence of significant difference in science career interest across U.S. middle school classrooms, thus a null hypothesis of no differences in science career interest was rejected. The analysis also suggested that 27% of the variance in science career interest scores was due to classroom factors and 73% was attributed to student factors plus error.

When classrooms used web resources during science lessons students had, on average, a 3.86 point higher score in science career interest than students in classrooms that did not employ web resources. Similarly, there was a significantly higher score, on average, of 2.68 points in student science career interest in classrooms that used human resources as compared to science classrooms that did not use human resources.

The interaction of gender and human resources resulted in a positive estimated coefficient indicating that human resources were potentially important predictors of science career interest for boys. The interaction of gender and web resources resulted in a negative estimated coefficient indicating that the use of web resources was potentially a more important predictor of science career interest for girls. Data were split by gender to investigate the relationships further.

The mean science career interest score for boys was 23.69. The use of human resources was a significant predictor of science career interest for boys. When human resources were used in the science classroom, boys, on average, scored 2.68 points higher than boys in classrooms that did not use human resources. Using web resources did not significantly predict science career interest for boys. The use of both human and web resources also did not significantly predict science career interest for boys.

When human resources were used in science class girls, on average, scored 4.5 points higher in science career interest than girls in classrooms that did not use human resources. In addition, girls scored, on average, 7.1 points higher in science career interest when web resources were used in the classroom than girls in classrooms that did not use web resources. When both web and human resources were used in science class, the interaction effect of both produced, on average, an increase of 16.2 points (t=2.252, p<.036) in science career interest for girls. (See Table 2 and Figure 1.)

Table 2. Classroom-Level Resource Effects for Boys and Girls

Fixed Effects	Estimated Coefficient	Standard Error	T-Ratio	P-Value
BOYS*				
Science Career Interest Mean	23.69	.54	44.017	0.000
Use of Human Resources	2.68	2.26	2.187	0.048
Use of Web Resources	2.14	1.88	1.139	0.269
Human x Web Resources	1.29	2.61	0.495	0.626
GIRLS**				
Science Career Interest Mean	23.34	.42	55.207	0.000
Use of Human Resources	4.54	1.78	2.555	0.020
Use of Web Resources	7.06	1.43	4.941	0.000
Human x Web Resources	4.63	2.06	2.252	0.036

Note: * Boys: N = 297, Model 2 Intercept Reliability Estimate = .597
** Girls: N = 304, Model 2 Intercept Reliability Estimate = .514

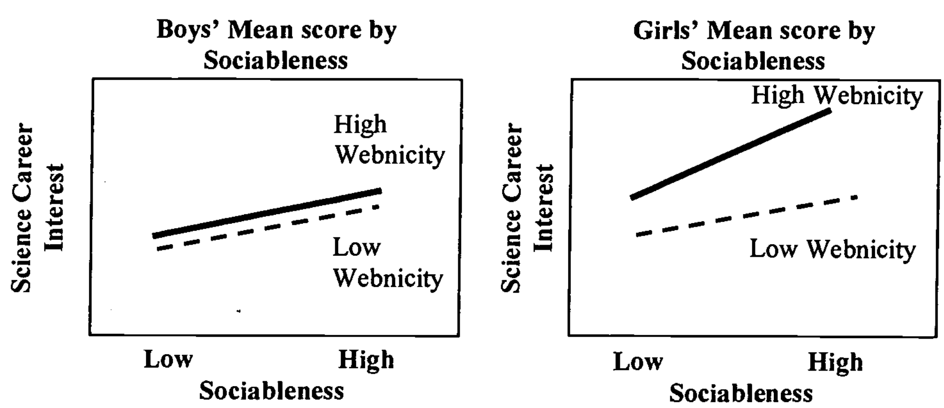

Figure 1. Science Career Interest Scores for Boys and Girls in Science Classrooms High and Low in Webnicity, by Sociableness

Conclusions

Developing interest in specific career domains is a consequence of many learning interactions with the people, information, and objects of the practice (Lave & Wenger 1991). The significant relationships found in this study support a conceptual hypothesis that increasing the richness of information through human and web resources during science class was related to higher levels of science career interest in middle school students. The differences found indicated that science career interest was predicted differently for boys and girls given the types of resources used regularly in science class.

These findings shed new light on understanding the complex relationships between the use of resources in the classroom and multiple factors that affect the development of science career interest. Without an understanding of the relationships between the types of resources used in the educational environment and student science career interest there is a risk that large investments in educational resources will go unmatched in student outcomes. The results of this study demonstrated that using resources high in sociableness and webnicity during science in this sample of students was positively and significantly related to higher levels of student interest in pursuing science careers.

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