Relationships between the use of web resources and student interests in science: Support for technology integration decision-making

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Abstract: This study was designed to investigate the relationships among the use of web resources during middle school science and student science career interests. The results indicated that there were significant predictive relationships between the regular use of web resources and science career interest. Findings suggested that regular use of web resources predicted science career interest scores differently for boys and girls. The regular use of web resources was not predictive of boys' career interests, only predictive of girls' interests in science careers. The use of web resources also had a mediating effect on other characteristics that are generally associated with developing interests in science. Understanding these relationships can help strengthen the processes of designing science education and support decision-making related to securing educational resources that may inspire students to pursue science.

Introduction

The U.S. invests millions of dollars each year on developing and securing new technology-based resources to inspire students to pursue science. To assure these investments are meeting the goals of the educational system it is important to understand the relationships among the types of resources used during science and levels of student interest in science. However, identifying the relationships among resources and interest requires consideration of the complex and multi-leveled environment of the classroom. This study investigated questions about these relationships. Is regularly using web resources during science predictive of middle school students' interest in science? Is the predictive nature of using web resources the same for boys and girls? Is the use of web resources related to differences in science predisposition factors among students?

Career Interest Development

Career development research generally has focused on identifying relationship among family factors such as parents' education and career (Helwig, 1998) and specific school-based career interventions (Hill, et al., 1990) thought to affect children's formation of career aspirations and their eventual participation in adult careers. Gallagher's (1994) work demonstrated that instructional experiences in middle school were predictive of persistence in the study of science in later years. However, no research could be found that investigated the relationships among use of specific educational resources and student science career interests. 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 (Hill, et al., 1990, Neimeyer & Metzler, 1987; Vondracek, Lerner, & Schulenberg, 1986; Super, 1984). Emergent interests in a career domain leads to intentions or goals for further activity exposure, which increases the likelihood of subsequent task selection and practice (Lent, Brown, & Hackett, 1994; Flum & Blustein, 2000). Career interest development begins in pre-adolescence, before the fifth grade, when patterns of career aspirations have a tendency to reflect development of the individual's sense of industry (Erikson, 1963; Havighurst, 1964) and interests in line with those careers held by family members or based on direct suggestions from parents or significant family members (Helwig, 1998; Trice, 1992). When children enter into the early stages of adolescence and begin to explore relationships and activities outside the family, including experiences in formal education, they often begin to develop career interests independent of family members. In addition to formal and informal learning experiences, much research has shown that adolescents' development of science career interests is also related to several predisposition factors including the adolescent's 1) perceptions of science – can I see myself as a scientist, 2) perceptions of friends' and teachers' interests in science – are my peers and mentors interested in science, 3) participation in science activities at home

and outside of school, 4) use of computer technology in the home, and 5) gender (Boone & Butler Kahle, 1998; Borget & Gilroy, 1994; Gallagher, 1994; Hill et al., 1990; Rocheleau, 1995; Yager & Yager, 1985). Thus, adolescents may be predisposed to pursuing science careers based on relationships with family and friends, formal educational experiences, and career exploration activities during adolescents that support the selection and de-selection of career domains that the individual will eventually choose to pursue (Gottfredson, 1981; Gati 1986). Career interests are therefore learned based on a variety of individual, background, and social factors and further developed as a child proceeds through adolescence. Furthermore, Lent, et al. (1994) suggested that psychological development of career interest is linked to formal academic experiences.

Factors that may affect career interest development

As the Internet becomes more commonly used in classrooms, opportunities to further explore career activities, tools, and people are more available. Recent 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. Thus, web resources provided vast and easily accessible information and human resources that promoted exploration of and interaction with additional information resources. Adolescent may be able to develop more informed self-perceptions of working within a specific career while interacting with web resources, e.g., participating in exploration and feedback processes. These perceptions may in turn influence science career interest (Blustein et al., 1994). Another factor found to be important in career interest development was gender. Often family experiences (Hanson, 2000) and perceptions of career-related opportunities (Roeser, Eccles, & Sameroff, 2000) strongly influence girls' career choices. Providing rich environments that include web resources, could influence girls choices because science is perceived as a more traditionally 'male' career (Hanson, 2000; Andre, Whigham & Hendrickson, 1999), and thus girls' interests will be more contextually influenced by exposing them to the vastness of science careers and those female role models who excel in science careers. Girls also tend to be more oriented towards social relationships (Swanson, 1997; Gurian, 2001) and may thus be particularly swayed by human contact and collaborative activities generally associated with the collaborative use of web resources in school settings. Since girls tend to work together more collaboratively when using technology and use computers more for learning activities where boys were found to use computers alone and for purposes of gaming, web resources may have more influence on shaping girls career interests (Swanson, 1997).

The Study

A one-time cross-sectional observational method was used to collect data from more than 600 middle school students and their teachers in a diverse group of 23 science classrooms from in three states (Koszalka, 1999). All classrooms were required to have school access to web resources, although there was no requirement that teachers had to use these resources. The middle school students who participated were intact groups from the science classrooms taught by the participating teachers. The dependent variable was Science Career Interest. The science career interest measurement scale was continuous with possible scores ranging from 0 to 36. The higher the score, the more interest the student has in pursuing science-related careers. The student-level independent variable measures were predisposition factors: 1) perception of science, 2) perception of others' interest in science, 3) parental and home factors, 4) interest in science-related activities outside of school, 5) computer technology use in the home, and 6) gender. Teachers were asked to provide information on classroom-level factors, e.g., the types of resources used regularly in the classroom.

Science Career Interest was measured by administering the Investigative (science) career interest summary scale of the Self-Directed Search Career Explorer (SDS), a career-counseling tool for middle school children. As in previous career interest exploratory analyses (Borget & Gilroy, 1994), only the scales for science careers were used so that a relative measure of interest in science careers could be obtained for each participating student. To classify the classroom into resources use types, the teachers were asked to respond to six questions regarding the use of different types of resources during science activities. Responses provided an indication of resource use patterns and were used to classify classrooms into a one of four resources use types.

The career instruments were administered to middle school students at the beginning of a science class at the end of the school year. At the same time, teachers completed the teacher survey, collected the completed surveys

and informed consent forms, and sent them to the researchers. Descriptive data were computed using SPSS version 8.0 for Windows. Hierarchical linear models (HLM) were used to examine the associations among classroom-level factors, student-level predisposition factors, and science career interest using two-level hierarchical linear models. This analysis could assess how science career interest differed depending upon classroom variables and on the individual characteristics they brought to the situation, i.e., predisposition factors and gender.

Findings

A total of 677 surveys, from 23 teachers in 9 schools were administered and returned. Fifty-eight surveys were either returned without signed parental consent forms or with incomplete data and were removed from the sample. The remaining 619 surveys were used in the data analysis that included 51% girls (n=304) and 49% boys (n=297). Eighteen students in the sample did not identify their gender. Mean scores were calculated for all boys' and girl's interest in science careers in general and for groups of boys and girls who exhibited each characteristic associated with different levels of predisposition to pursue science. The HLM analyses demonstrated that use of web resources overall was not predictive of boy's science career interests ($t = 2.077$, $p < .061$). Girls' science career interest was predicted by the regular use of web resources ($t = 4.323$, $p < .000$). (See Tab. 1)

Fixed Effects	Estimated Coefficient	Standard Error	T-Ratio	P-Value
BOYS				
Science Career Interest Mean	23.73	0.52	45.060	0.000
Use Web Resources	2.80	1.28	2.077	0.061
Perception of Others slope	0.72	0.27	2.624	0.017
Perception of Others Interests X web slope	-0.42	0.32	-2.298	0.029
Perception of Science slope	0.59	0.09	6.664	0.000
Perception of Science X web slope	0.29	0.10	2.911	0.009
Notes: N = 297, Intercept Reliability Estimate = .700				
GIRLS				
Science Career Interest Mean	23.31	0.46	50.305	0.000
Use Web Resources	4.93	1.14	4.323	0.000
Outside Science Activities slope	0.17	0.24	0.743	0.466
Outside Science Activities X web slope	0.41	0.29	4.700	0.000
Perception of Science slope	0.51	0.09	5.202	0.000
Perception of Science X web slope	0.33	0.12	2.849	0.010
Notes: N = 304, Intercept Reliability Estimate = .651				

Table 1: Student-Level Effects for Boys and Girls

The relationships among science career interests and predisposition factors were different in classrooms where web resources were and were not used regularly. As boys' ($t = 6.664$, $p < .000$) and girls' ($t = 5.202$, $p < .000$) perception of science increased, so did their interest in science careers. For both boys and girls a significant interaction was found between their perception of science and classroom use of the web. The interaction slopes indicated that there were stronger relationships between perceptions of science and science career interest for both boys ($t = 2.911$, $p < .009$) and girls ($t = 2.849$, $p < .010$) when web resources were used in the classroom than when web resources were not used. Perceptions of others' interest in science was positively related to boys' science career interest ($t = 2.624$, $p < .017$). The interaction between perceptions of others' interest in science and use of web resources in science class in boys resulted in a significant negative relationship ($t = -2.298$, $p < 0.020$). The level of interest in science-related outside activities was not significantly related to science career interest for girls ($t = 0.743$, $p < .466$) on its own. However, the interaction between interest in science-related outside activities and use of web resources in science class for girls resulted in a significant

positive relationship ($t = 4.700$, $p < 0.000$). Home technology use and parent/home support to pursue science did not have a predictive relationship for science career interest in either boys or girls, nor were the strengths of their relationships different in the students who used web resources, hence they were dropped from the model.

Discussion

Developing interest in specific career domains, such as science, is a consequence of many learning interactions with the people, information, and objects of the practice (Lave and Wenger, 1991). Conceptually, previous research provided indications that working with science practitioners and exploring science information was important to the development of interests in science careers (Vondracek, 1993; Helwig, 1998; Hill et al., 1990). The use of web resources during science can provide adolescents with opportunities for exploring science by providing access to additional social and supportive information. Thus, the significant relationships found support a conceptual hypothesis that increasing the richness of the types of information through web resources during science was related to higher levels of science career interest. In addition, this study provided some interesting findings related to the relationship among the use of web resources and girls interests in science careers. The findings suggested that the use of web resources might have acted as an influencing agent supporting girls developing interests in science because they potentially exposed them to rich examples of science in practice. They may also have provided motivational and interactive experiences as well as another venue for social interaction and learning through collaborative activities with fellow students.

The results of this study also suggested that the relationships between science career interest and predisposition factors were different in classrooms where students regularly used web resources and classrooms where students did not use web resources. For example, all boys' interests in science were predicted based on their perceptions of other's interests in science. If their friends 'liked' science, they were much more likely to 'like' science themselves. When comparing students in classrooms that used web resources and those who did not, the relationship was different. Perceptions of others' interests was not as strong a predictor potentially indicating that sources on information available on the web became more important in informing interest than perceptions' of others in the adolescent's life. Thus, factors such as the use of web resources in classrooms may play a significant mediating role in shaping a student's interests in science careers.

Understanding relationships between the use of web resources and students' science career interests can provide a basis for developing and securing resources that have been empirically shown to be related to higher interest in science careers. If these results hold up in replication studies, there are implications that may support academic decision-making and policy. Given a goal of inspiring students to pursue science careers, policy makers may find this type of research supportive of decisions to allocate financial commitments for enhancing computer equipment, facilitating curriculum development that brings science learning and science communities together, providing teachers with the time and training to integrate web resources into their teaching. 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 use of resources in the classroom 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 the regular use of web resources in middle school science classrooms were predictive of girls' interests, but not boys' interests in science careers. The use of web resources also seemed to have a mediating effect on the relationship among predisposition factors to pursue science and science career interest. Understanding such relationships can inform decision- and policy-making in regard to providing access to, and support of, web technology use in the classroom.

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