Technology Resources as a Mediating Factor in Career Interest Development

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ABSTRACT
This study examined the strength of predictive relationships between predisposition factors of middle school students to pursue science careers and student level of science career interest when web resources were used and not used regularly during science class. Predisposition factors predictive of boys’ interests in science careers were their: 1) perceptions of science and, 2) perceptions of others’ interest in science. These relationships were different in classrooms where web resources were and were not used. The relationship between boys’ perceptions of science and science career interest was stronger for boys in classrooms where web resources were used regularly in the science classroom. The predictive relationship between boys’ perceptions of others’ interest in science and their own interest in science careers was weaker in classrooms where web resources were used regularly. Girls, in general were more interested in science careers when they participated in science activities outside of class and had higher perceptions of themselves growing up to be scientist. Both of these factors were stronger predictors of science career interest for girls in science classrooms that regularly used web resources. These findings suggest that the use of web resources may play an important role in strengthening or weakening the predictive nature of career determining predisposition factors and the development of science career interest in adolescents.

Key words
Career interest, Gender differences, Middle school science, Web resources

‘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)

Introduction

Conceptually, becoming a member of a practice requires that an individual build associations with the information, and relationships with the people, that define that practice (Lave & Wenger, 1991). Theorists in the field of human development generally agree that one of the main tasks during adolescence is to become prepared for eventually assuming a viable role in a practice within the world of adult work and their environment plays a role in preparing them for such roles (Vondracek & Porfeli, in-press). These statements raise a question about factors in the adolescent’s educational environment that can affect their career choices. Career development researchers have identified background factors that predispose adolescents to pursuing certain careers, such as perceptions of themselves in a career, perceptions of their friends’ interest in certain subjects, and participation in hobbies and clubs outside of school (Boone & Butler Kahle, 1998; Gallagher, 1994; Hill, Pettus, & Hedin, 1990; Koszalka, 1999). Research, however, suggests that interactions with resources, such as the tools and people in a practice during formal educational activities, also inform student interests, helping adolescents resolve their own questions of career choice (Kahle, Matyas, & Cho, 1985; Mason & Kahle, 1988; Trice, 1992). Little research exists that specifically explores the relationships among the career interest predisposition factors, adolescents’ development of science career interests, and specific types of resources used in the formal classroom.

Career development research generally has focused on identifying relationships among factors such as parents’ education and career (Helwig, 1998; Trice, 1995) 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. Koszalka (1999) found that there were predictive relationships between the types of resources used in the classroom and middle school students’ level of interest in science careers. Findings suggested that the regular use of human resources from outside the science classroom during science activities predicted higher levels of interest in science careers for both boys and girls. The regular use of web resources was predictive only of girl’s level of interest in science careers. There were, however, indications
that the strength of relationship between some career predisposition factors and student level of science career interest was different for those students in classrooms that regularly used web resources during science than for those students who did not use the web.

The goal of this study was to further investigate strengths of the relationships between predisposition characteristics of students and interests in pursuing science careers under different classroom environments, namely those that regularly integrated web resources into science teaching and those that did not. These analyses took into account differences in these predictive relationships for adolescent boys and girls.

Career interest formation, family, and predisposition factors

One of the most powerful predictors of career choice is interest (Hill et al., 1990; Holland, 1985; Mason & Kahle, 1988; Neimeyer & Metzler, 1987; Vondracek, Lerner, & Schulenberg, 1986). 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). 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 (Flum & Blustein, 2000; Lent, Brown, & Hackett, 1994).

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, 1995). 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. Much research has shown that adolescents’ development of science career interests is 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; Gibson & Francis, 1993; Hagen, 1960; 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 as well as career exploration activities during adolescents that support the selection and de-selection of career domains that the individual will eventually choose to pursue (Gati 1986; Gottfredson, 1981). 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.

Perception of self as a scientist and perception of other’s interest in science

Early adolescents may, for the most part, be far removed from any kind of meaningful vocational commitment. However, early adolescents may already be involved in some important vocational exploratory activities (Vondracek, 1993). Several studies support the notion that developing knowledge, skills, and interest in a particular career is highly dependent on contextualized interaction with the tools and people involved in that career (Hutchins, 1998; Jordan, 1989; Lave & Wenger, 1991; Marshall, 1972). Students need to be provided with connections to people who can support their development of interests in specific areas, with opportunities to practice career-related activities, and opportunities to use the resources and tools of a practice in the context of exploring specific careers. Subject-based classrooms, such as science, can provide students with formal experiences in science. These experiences in turn can provide adolescents with the feedback necessary to determine whether they like a certain field and can see themselves as a practitioner in that field in the long run.

The success of these classroom experiences influencing career interest in science is at best questionable based on the many different factors that influence the development of career interests, such as background and support of parents. Individuals do not simply acquire all of the features of a practice presented to them, nor do they accept the identity categories that may be assigned to them (Eisenhart, 1995, Lave & Wenger, 1991). Instead, they often reject components of the identities and practices imposed on them in formal classroom environments and develop a sense of self as individuals in contexts to pursue the mastery of skills, knowledge, and emotions associated with a particular social practice (Holland, 1992). The experiences in the classroom may provide the student with exposure to various resources and practices; however, it is the individual who chooses the
experiences that shape his/her interests and pursuits. Predisposition factors such as perceptions of self in a certain role or perceptions of other’s interests have been found to play a role in career interest development (Boone & Butler Kahle, 1998; Kahle, Matyas, & Cho, 1985; Koszalka, 1999).

Although open to exploring new areas, adolescents are strongly influenced by peers and other acquaintances or by participating in activities outside the home (Helwig, 1998; Rocheleau, 1995; Trice, 1995). Hill et al. (1990) found that interactions with reference groups, including peers, fellow club members, and informal exchanges with family members, affected middle school students’ interests in science-related careers. Perceptions associated with reference groups, such as “my friends like this subject” or “I have similar characteristics to others in this groups,” played a significant role in children expressing occupational preferences. Thus, interactions with reference groups or significant others can become sources of encouragement or discouragement in selecting career choices.

There was also evidence that as students began to mature and develop their own conceptions of who they were and who they wanted to be, exploratory and learning experiences in school influenced their career interests. Blustein et al. (1994) found that during adolescence strong relationships were formed between progress toward making career decisions and participating in exploratory activities. Being able to explore career-related information, participate in career-specific activities, and work with the people and tools of many different careers provided students with the feedback and reinforcement important to developing career interest and making career decisions.

Web technology and career exploration

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).

Gender differences in career decision making

Another factor found to be important predictor of career interest development was gender. Many studies have focused on ‘underserved’ populations such as young girls who often opt out of science-related careers for a variety of reasons. Often family experiences (Hanson, 2000) and perceptions of career-related opportunities (Roese, Eccles & Sameroff, 2000) strongly influence girls’ career choices. Hypothetically, providing rich environments that include web resources, could better inform girls’ career options. Since science is socially perceived as a more traditionally ‘male’ career (Andre, Whigham & Hendrickson, 1999; Hanson, 2000), girls’ interests could be more contextually influenced by exposing them to the vastness of science-related careers and those female role models who have excelled in science careers. Interacting with these types of resources could be enlightening girls’ as to the possibilities of participating in science careers. Thus, career exploration in areas perceived to be socially unpopular for girls could be increased by informing girls of the variety of science-related careers and successful women of science, thereby peaking interest.

Although a theoretical possibility, there is little evidence suggesting that there are differences in relationships between adolescent’s career predisposition factors and their interests in science careers in classrooms that use different types of resources during science class. This study sought to answer the following questions:

1. Which predisposition factors were predictive of boys and girls interests in science careers?
2. Was the strength of the predictive relationships between science career interests and specific predisposition factors different for boys and girls in classrooms that regularly used web resources than those that did not?

Methodology

A one-time cross-sectional observational method was used to collect data from more than 600 middle school students in a diverse group of science classrooms in Pennsylvania, California, and North Carolina schools
All schools were of a middle class socioeconomic status located in rural or suburban communities. Participating teachers were not required to have completed any special teaching certification programs or be regularly using any specified procedures, materials, or technologies. All classrooms were required to have school access to web resources, although there was no requirement that teachers had to use these resources regularly. The middle school students who participated in the study were intact groups from the science classrooms taught by the participating teachers.

**Study variables**

The dependent variable for this study was Science Career Interest (SCIINT). The science career interest measurement scale was continuous (interval/ratio) with possible scores ranging from 0 to 36. The higher the score, the more interest the student had in pursuing science-related careers. See Table 1.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Measure</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DEPENDENT MEASURE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science career interest – SCIINT</td>
<td>Sum of 24 items</td>
<td>Continuous</td>
</tr>
<tr>
<td><strong>INDEPENDENT MEASURES (student predisposition)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceptions of science – PRCSCI</td>
<td>Sum of 6 items</td>
<td>Continuous</td>
</tr>
<tr>
<td>Perception of others interest in science – PRCOTH</td>
<td>Sum of 6 items</td>
<td>Continuous</td>
</tr>
<tr>
<td>Parental and home factors – PARHOME</td>
<td>Sum of 2 items</td>
<td>Continuous</td>
</tr>
<tr>
<td>Interest in science-related activities outside of school – OUTACT</td>
<td>Sum of 3 items</td>
<td>Continuous</td>
</tr>
<tr>
<td>Home technology use – HOMETEC Gender – GEND</td>
<td>Boy=1, Girl=0</td>
<td>Nominal</td>
</tr>
<tr>
<td><strong>CLASSROOM MEASURES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resources regularly used in science class – RESTYPE</td>
<td>1=No Human/No Web 2=Human/No Web 3=No Human/Web 4=Human/Web</td>
<td>Nominal</td>
</tr>
</tbody>
</table>

*Table 1.* Study variables

The student independent variable measures were collected on the following six factors career interest predisposition factors: 1) perception of science (PRCSCI), 2) perception of others’ interest in science (PRCOTH), 3) parental and home factors (PARHOME), 4) interest in science-related activities outside of school (OUTACT), 5) computer technology use in the home (HOMETEC) and 6) gender (GEND). Teachers were asked to provide information on classroom, e.g., the types of resources used regularly in the classroom (RESTYPE).

**Science career interest and classroom-level measurement instruments**

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. According to Becker’s (1998) guidelines responses provided an indication of resource use patterns and were used to classify classrooms into one of four resources use types (RESTYPE).

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. The teacher collected the completed surveys and informed consent forms from the students and their parents, sealed the materials in a provided envelope and sent them to the researcher who cross-checked surveys and consent forms and cleaned and analyzed the data.
Data Analysis

Descriptive data were computed using SPSS version 8.0 for Windows. Hierarchical linear models (HLM) were used to examine the associations among classroom factors, student predisposition factors, and science career interest using two-level hierarchical linear models. Hierarchical linear modeling (HLM), a technique designed to decompose variance into common source and situational variance (Bryk & Raudenbusch, 1992), was used to assess the extent to which adolescents’ level of science career interest could be predicted based on classroom variables, for example, the use of web resources in the classroom. The analysis also was used to assess how science career interest differed depending upon classroom and on the individual, or student predisposition factors, for example, the characteristics students brought to the situation, such as perceptions of being scientists and their gender. Hierarchical Linear Modeling (HLM) was used to identify variability in the sample, the amount of variance that could be attributed to classroom and student variables, students predisposition factors that were predictors of science career interests, and the direction and strength of relationship between predisposition factors and science career interest under different classroom conditions.

Results

Nineteen hundred and nineteen surveys were distributed to 50 classroom teachers in 14 schools. A total of 677 surveys, from 23 teachers in 9 schools were returned. Fifty-eight of the returned surveys were either returned without a signed parental consent form or with incomplete data and were removed from the sample. The remaining 619 surveys, 92% of the returned 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 each characteristic associated with different levels of predisposition to pursue science for both boys and girls (see Table 2).

As boys’ (t = 6.664, p < .000) and girls’ (t = 5.202, p < .000) perception of science (predisposition factor) 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.

In general, perceptions of others’ interest in science (predisposition factor) was predictive of 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 for boys resulted in a significant negative relationship (t = -2.298, p < 0.020) indicating that there was a weaker relationship between boys’ perceptions of others and their own interest in science careers, suggesting that in science classrooms using web resources regularly, boys’ perceptions of their friends’ and teachers’ interest in science was not as an important predictor of science career interest.

The level of participation in science-related activities outside of class (predisposition factor) was, in general, not significantly related to science career interest for girls (t = 0.743, p < .466). However, the relationship changed in the presence of web resources use. The interaction between participating in science-related activities outside of class and use of web resources in science class for girls resulted in a significant positive relationship (t = 4.700, p < 0.000) indicating a stronger relationship between participation in science-related activities outside the classroom and science career interests for those girls in classrooms that regularly use web resources as opposed to those who did not.

<table>
<thead>
<tr>
<th>Student-level factors</th>
<th>BOYS Low level</th>
<th>BOYS High level</th>
<th>GIRLS Low level</th>
<th>GIRLS High level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>mean</td>
<td>S.D.</td>
<td>n</td>
</tr>
<tr>
<td>Home Technology Use</td>
<td>118</td>
<td>23.27</td>
<td>5.23</td>
<td>179</td>
</tr>
<tr>
<td>Perception of others’ interest in science</td>
<td>50</td>
<td>20.36</td>
<td>6.80</td>
<td>247</td>
</tr>
<tr>
<td>Interest in outside</td>
<td>95</td>
<td>22.47</td>
<td>7.03</td>
<td>202</td>
</tr>
</tbody>
</table>
Home technology use and parent/home support to pursue science (predisposition factors) did not have a significant predictive relationship to science career interest for either boys or girls, nor were the strengths of their relationships different among students who used web resources regularly during science and those who did not.

### Table 2. Mean Science Career Interest Scores, Standard Deviations for Boys and Girls with Different Levels of Predisposition Characteristics

<table>
<thead>
<tr>
<th></th>
<th>BOYS</th>
<th>GIRLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Effects</td>
<td>Estimated Coefficient</td>
<td>Standard Error</td>
</tr>
<tr>
<td>Science Career Mean</td>
<td>23.73</td>
<td>0.52</td>
</tr>
<tr>
<td>Use Web Resources</td>
<td>2.80</td>
<td>1.28</td>
</tr>
<tr>
<td>Perception of Others’</td>
<td>0.72</td>
<td>0.27</td>
</tr>
<tr>
<td>Perception of Others’</td>
<td>-0.42</td>
<td>0.32</td>
</tr>
<tr>
<td>Perception of Science</td>
<td>0.59</td>
<td>0.09</td>
</tr>
<tr>
<td>Perception of Science</td>
<td>0.29</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Notes: N = 297, Intercept Reliability Estimate = .700

### Table 3. Student-Level Predisposition Effects for Boys and Girls

In summary, generally perception of science (predisposition factor) was a predictor for boys and girls; perception of others’ was a predictor for boys, not girls, and participating in outside science-related activities was a predictor for girls, not boys. See Table 4 summary of these data.

### Table 4. Summary of predictive relationships among predisposition factors and science career interest for boys and girls

Boys’ perception of science, for example, seeing themselves as a scientist, was a stronger predictor of science career interest when web resources were regularly used in the science classroom (see the top left graph in Figure...
1) as opposed to those that did not regularly use web resources. Boys’ perception of other’s interests in science was a less important predictor of science career interest in classrooms that regularly used web resources as opposed to those that did not use web resources (see the bottom left graph in Figure 1).

Figure 1. Boys’ & girls’ predisposition factors and science career interest in classrooms that use and do not use web resources

For girls, when web resources were used in the classroom both perception of science (see the top right graph in Figure 1) and interest in outside science-related activities (see the bottom right graph in Figure 1) were stronger predictors of science career interests in classrooms that used web resources as opposed to those that did not.

Discussion

Much of the literature on career and vocation development suggests that pre-adolescent children’s career interests are shaped by family interactions. As children enter adolescence and begin to struggle with the choices that lead to their own identity development, exposure to information, activities, and people in different types of careers begins to play a role in the selection and de-selection of career domains. Factors that predispose adolescents to science careers also play an important role in their eventual choices.

The results of this study confirmed much of the literature on factors related to career interest development. For example, important predictors of science career interests for these students were perceptions of one’s self as a scientist, perceptions of other’s interests in science, and participating in science-related activities outside of formal classroom environment. The literature suggested that the use of technology resources at home and family background in science also predicts student science career interest. This was not the case in this study. Neither home technology use nor parental support were significant predictors of these students science career interests, either by gender or by web use in the classroom for these students.

This analysis also suggested that the relationships between science career interest and significant predisposition factors were different in science classrooms where students regularly used web resources and science classrooms where they did not use web resources. For example, boys’ interests in science careers were predicted based on their perceptions of others’ interests in science and perceptions of themselves as scientists. However, in classrooms that used web resources the strength of these relationships were different. The perception of others’
interest in science was a weaker predictor and perception of self as a scientist was a stronger predictor of science career interest. The differences in these relationships might suggest that sources of information available on the web became more important in informing student career interest than their perceptions’ of others interests in science and web resources provide more sources of information that enhanced the boys’ perceptions of themselves as scientists.

There may however have been other factors influencing the strength of these relationships. Teachers who used web resources regularly may have been using different teaching and learning strategies that further engaged students in exploratory activities, thus affecting their interest levels. There may have also been differences in the teachers’ attitudes toward science in the classes that used and did not use web resources in the classroom, again influencing student’s levels of interest.

This analysis does suggest differences in the relationships between predisposition factors and science career interests for boys and girls in science classrooms that use and don’t use web resources. Thus, the use of web resources in classrooms may have been playing a significant mediating role in shaping student interests in science careers. More research is needed to examine if the regular use of web resources in science class is an influencing factor in the development of science career interests.

For this sample of students, it appears that the use of web resources mediated changes in the strength of relationship between predisposition factors to pursue science and science career interest among boys and girls. Developing a better understanding of the relationships among predisposition factors and student interest levels under resource use conditions will help to develop evidence in support of investments in educational technology resources that will be likely to promote development of student interest in science careers.

References


