Gender-based Preferences toward Technology Education Content, Activities, and Instructional Methods

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Prominent U.S. economists and educational leaders have argued that citizens must become technologically literate to maintain economic growth (Bybee, 2003; Colaianne, 2000; Greenspan, 1997). All students of both genders need to acquire the skills necessary to become consumers capable of critically assessing the technologies they use, resulting in the ability to make more informed decisions.

One of the key problems confronting educators in the SMET disciplines (science, mathematics, engineering, and technology) is the disproportionate lack of involvement of females. Females' lack of participation has been attributed to curriculum content that is biased toward males' interests (Sanders, Koch, & Urso, 1997). Others (Shroyer, Backe & Powell, 1995) attribute females' lack of interest to pedagogical approaches rather than to the inherent nature of the subject.

One significant challenge is culturally-grounded gender stereotyping, which has a substantial influence on children's self-concepts (Witts, 1997). In a variety of ways, the media, peers, and adults communicate and reinforce gender-based stereotypes (Martin, Eisenbud, & Rose, 1995). For example, toys have a powerful influence on what children perceive as appropriate for boys and girls. Toys designed for boys tend to be highly manipulative or electronic whereas girls' toys are less likely to be manipulative or have interchangeable parts (Caleb, 2000; Sanders 1997). Girls' toys also tend to feature interpersonal interaction, such as dolls, which encourage the development of social skills and relationships (Caleb, 2000). Sanders, Koch, and Urso (1997) assert that girls who are not exposed to toys that encourage scientific, mathematical or technological thinking are less likely to develop an interest in related subject areas at school.

In a study of the interest patterns of middle school students, Shroyer, Backe, & Powell (1995) found that socially relevant topics were more appealing

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to girls, in contrast to boys who were more interested in how things work. They also found that girls were more interested in topics related to the environment, people, and the application of this knowledge to social conditions than were males.

Given the historically disproportionate involvement of males in industrial arts and technology education, male perspectives and interests tend to pervade the technology education curriculum (Sanders, Koch, & Urso, 1997; Welty, 1996). The *Standards for Technological Literacy* represent a positive movement in addressing this concern, since the structure of the standards provides for diverse ways of developing curriculum and representing the interests of both genders. Curriculum developers in technology education need to be informed by research and theory designed to comprehend "women's ways of knowing" if they hope to effectively recruit and retain women and girls into the study of technology (Belenky, Clinchy, Goldberger, & Tarule, 1986; McIntosh, 1983; Welty, 1996; Zuga, 1999). Shroyer, Backe, & Powell (1995) indicate that the study of environmental and social technologies may be more appealing to girls than the study of industrial technologies.

Pedagogical considerations are also critical to sound gender-balanced curriculum design. Research has found that there are instructional methods, learning styles, and interests that can be characterized as distinctively female (Brunner, 1997; Jacobs & Becker, 1997; McIntosh, 1983; Rosser, 1985; Zuga, 1999). Additionally, curriculum materials need to connect in meaningful ways with students' prior experiences and the world in which they live (Zuga, 1999).

Teachers are encouraged to construct knowledge from students' experiences (Belenky, Clinchy, Goldberger, & Tarule, 1986; Jacobs & Becker, 1997). While this is important for all students, it is particularly important that teachers and curriculum designers in the SMET disciplines attend to the experience base of female students. Students often feel that content lacks relevance to their lives (Markert, 2003; Jacobs & Becker, 1997; Sanders, Koch, & Urso, 1997). It is important to connect students to content through their life experiences (Wills, 2000). Rather than continually using traditional tools, material, or examples to demonstrate technological concepts, teachers should use examples with which both genders can identify.

Females prefer collaboration over competition (Chapman, 2000; Fiore, 1999; Jacobs & Becker, 1997; McIntosh, 1983; Rosser, 1990; Sanders, Koch, & Urso, 1997). This is consistent with contemporary trends in technology education, where the historic use of individual projects is shifting toward small group work. However, contemporary practice also employs the substantial use of student competitions. For example, although the Technology Student Association (TSA) and the Technology Education Collegiate Association (TECA) feature collaborative activities, considerable emphasis is placed on the competitive aspects of the events.

Purpose and Methodology

The purpose of this study was to identify the types of learning activities, topics, and instructional methods in technology education that are preferred by middle and high school females and males. Specifically, three questions were posed:

1. Which activities, related to the study of technology, are most preferred by females and males at the middle school and high school levels?
2. Which curriculum content topics, related to the study of technology, are most interesting to females and males at the middle school and high school levels?
3. Which instructional methods, related to the study of technology, are most preferred by females and males at the middle school and high school levels?

A descriptive design was employed using two surveys designed by the researchers. One survey identified the interest preferences of students toward activities in technology education, while the second identified students' interest preferences toward content topics and instructional methods in technology education.

The population consisted of students enrolled in middle school and exploratory level high school technology education classes in Wisconsin. A purposive, stratified sample of consisting of eleven technology education programs (which had at least forty five minutes of contact time each day) was selected with the assistance of a representative from the Wisconsin Department of Public Instruction to ensure gender representation as well as coverage across urban, suburban, and rural areas. Within the eleven programs that agreed to participate, six were middle school programs (three were urban, one was suburban, and two were rural) and five were high programs (two were urban, one was suburban, and two were rural). Within the six middle school programs, one of the seven participating teachers was female. Within the five high school programs, one of the nine participating teachers was female.

To ensure gender representation, technology programs with high female enrollment were selected. Most school districts in Wisconsin require at least one technology education class for all middle school students; therefore, the study's middle school sample was gender balanced.

The sample size for the study was based on the Krejcie and Morgan's (1970) formula. A total of 348 middle school students and 311 high school students participated in the study.

Instrumentation

Two instruments were developed. The ***T**echnology **A**ctivity **P**reference* (*TAP*) Inventory consisted of a set of activities typically used in contemporary technology education classes. These were gleaned from a variety of carefully selected technology education curriculum materials with the assistance of state supervisors.

To ensure a broad representation of activity types, two conceptual frameworks were employed. First, activities were coded into context standards categories corresponding with Standards 14-20 in the *Standards for Technological Literacy* (ITEA, 2000). The second framework, generally corresponding to the types of activities involved in technological literacy as described in the *Standards*, as well as *Technically Speaking* (Pearson & Young, 2002), was comprised of designing, making, utilizing, and assessing.

Three technology educators with substantial experience with standards-based curriculum development reviewed the activities. They were instructed independently to rank order each activity according to its relevance, authenticity related to student experience, and distribution across each of the activity types. The final version of the *TAP* contained 56 activity items. Each item was rated on a 1-5 Likert-type scale according to level of student interest (from Very Interesting to Not Interesting at All).

The second inventory, **T**echnology topics and **I**nstructional methods **P**reference Inventory (*TIP*) focused on standards-based content topics. Topics were identified by reviewing the descriptive narrative, standards, and benchmarks of the *STL* (2000). The topics compiled for each of the twenty standards in the *STL* (2000) were submitted to the panel of technology education curriculum experts for rating. Rating criteria included representativeness of the standards category, coverage, and concreteness. The two topics receiving the highest composite ratings were selected for the instrument for a total of forty items (2 per *STL* standard). As with the *TAP* instrument, each item was rated on a 1-5 Likert-type scale according to level of student interest.

In addition to the content topics, the *TIP* also contained a list of instructional methods typically used in technology education programs (e.g., making projects, designing solutions, engaging in debate and discussion, etc.). These methods were identified through the literature review and were selected to be representative of gender preferences.

A pilot test was then conducted with a group of middle and high school students to ensure the instruments' clarity, students' understanding of directions and individual items, and ease of administration. Some minor modifications were made to the administration protocol and instruments as a result of the pilot test, primarily to ensure clarity. (Note: Additional detail about the instrument development process is presented in Weber, 2004).

Data Collection

Technology teachers from the selected programs were invited to participate in the study. After each teacher agreed to participate, informed consent and assent forms were distributed to students and returned to each teacher prior to administration. To ensure administration consistency, the researcher traveled to each school site to administer the surveys. The instruments were introduced with a full explanation of how to rate the items. To avoid fatigue from completing both instruments in the same class hour, a five-minute break was provided between the administration of the two instruments.

Data Analysis

The independent variables were gender and grade level. The dependent variables consisted of level of interest responses to the activities and topics. The activities and topics variables were analyzed separately using two-way factorial analysis of variance by gender and grade level. A descriptive analysis was also conducted to identify the activities and topics students rated most and least interesting. A crosstabs analysis provided a mechanism for analyzing both independent variables simultaneously.

The final step in the analysis focused on pedagogical preference, where students were asked to rank order their preference on three separate sections that included: instructional methods, instructional approaches to activities, and instructional groups. The rank order of each section was identified using a composite rank score, calculated by multiplying the number of people who ranked the item by the rank number. Separate composite ranking scores were computed for each independent variable to facilitate gender and grade level comparisons. Each of the three pedagogical item sets were then placed in rank order using this composite score, with the lowest score representing the most preferred method and the highest score being least preferred.

Findings and Discussion

Activity Preferences

A two-way factorial analysis of variance was conducted to compare gender and grade level differences for the activity variable. At the composite level (the entire activity data set), no significant differences were found between the interest ratings of females and males (see Table 1). At the subcategory level, however, significant gender differences were detected regarding interest in activities that involved *designing* and *utilizing*. Consistent with the literature, females rated the *design* activities more interesting than did males, while males preferred *utilizing* types of activities (Welty & Puck, 2001). No significant differences were detected between genders in the *make* and *assess* dimensions.

Table 1
Male and Female Interest Preferences toward Activity Categories

Activity Category	Sample Size		Mean		SD		
	M	F	M	F	M	F	p
Composite[a]	386	271	2.83	2.86	.72	.66	.321
Design	385	271	2.85	2.64	1.16	.69	.030*
Make	385	271	2.73	2.70	.80	.73	.878
Utilize	387	271	2.54	2.80	.70	.73	.000*
Assess	386	271	3.26	3.31	.86	.80	.518

Note. Lower numerical values indicate higher levels of interest and higher numerical values indicate lower levels of interest.
[a]Composite: comprised of responses toward all activities
* $p < .05$

The activities selected for the inventory had similar appeal to both genders. This is important since the activities were specifically selected to represent contemporary technology education. This suggests that the field is doing a reasonably good job of developing activities that are equally appealing to both genders. This study also suggests that curriculum developers appear to be doing a relatively good job of selecting and developing activities representing an appropriate gender balance.

Females' preference for *design* and males' preference for *utilizing* is generally consistent with gender stereotypes. This is particularly true when the *design* activities include a focus on problem solving or socially relevant issues. By contrast, males typically are attracted to a variety of building activities, which involve the use of machinery and tools. Traditional industrial arts activities have often tended to de-emphasize the *design* aspects of *making*, with students often working from existing project plans. It is possible that the increased emphasis on design in contemporary technology education courses could provide some balance between this *design* and *make/utilize* dichotomy and make technology education activities more appealing to both genders.

Responses to the four activity categories were also examined by grade level. Analysis of the composite activity set detected significant grade level differences (see Table 2). Middle school students rated the composite of activities more interesting than did high school students. Significant differences were also found with the *design*, *make*, and *utilize* activities. The relatively low interest in *assessing* activities is consistent with the culture of technology education, which tends to favor applications-oriented activities over reflection and analysis.

Table 2
Middle School and High School Interest Preferences Toward Activity Categories

Activity	**Sample Size**		**Mean**		**SD**		
Category	**MS**	**HS**	**MS**	**HS**	**MS**	**HS**	***p***
Composite[a]	345	310	2.78	2.92	.73	.65	.007
Design	346	310	2.62	2.92	.79	1.16	.002*
Make	345	311	2.60	2.84	.79	.73	.000*
Utilize	347	311	2.59	2.71	.76	.67	.004*
Assess	346	311	3.28	3.29	.88	.77	.994

Note. Lower numerical values indicate higher levels of interest and higher numerical values indicate lower levels of interest.
[a]Composite: comprised of responses toward all activities
* $p < .05$

During the instrument development, a deliberate attempt was made to select activities that would appeal to both middle and high school students. The activities were also judged to be representative of contemporary technology education activities. Consequently, it was somewhat surprising that middle school students rated the activities more appealing. One reason for this outcome could be that the technology education profession may be doing a better job of developing curriculum materials for the middle school than for the high school. This finding may reflect a coherence of curricular focus at the middle school level, which has yet to be achieved at the high school level, where programs tend to range from vocationally focused trade and industrial programs to engineering and pre-professional programs. Significant work remains to be done to conceptualize the discipline and curriculum materials for the high school level. This need is particularly pronounced at the advanced level, where the programs are diverse and where curriculum materials are scant and tend to be underdeveloped. The curriculum development challenge is further exacerbated in general by the problems associated with stimulating high school students' levels of interest in school (Rice, 1997; Roderick, 1993).

The data were also analyzed to identify activities that appeal and do not appeal to males and females. Several differences among males and females emerged. The top five activities rated interesting by females generally focused in the areas of communication or design (see Table 3). Consistent with the literature, females were interested in activities that support and facilitate communication and which are of social relevance (Jacobs & Becker, 1997; Markert, 2003; Sanders, Koch & Urso, 1997; Shroyer, Backe, & Powell, 1995). In striking contrast, males focused on transportation vehicles with an emphasis on utilizing and constructing. The interest in design-oriented activities was also less pronounced with males as was the use of computers to produce designs.

Table 3
Activities Rated Most Interesting

Female preferences at middle school and high school levels	***n******
1. Use a software-editing program to edit a music video	224
2. Using a computer software program, design a CD cover.	210
3. Design a model of an amusement park.	195
4. Design a school mascot image to print on t-shirts.	192
5. Design a "theme" restaurant in an existing building.	190
Male preferences at middle school and high school levels	
1. Build a rocket.	293
2. Construct an electric vehicle that moves on a magnetic track.	284
3. Perform simple car maintenance tasks on a car engine.	279
4. Program a robotic arm.	271
5. Design a model airplane that will glide the greatest distance.	268

* *n* = the number of students who rated the activity either "very interesting" or "somewhat interesting"

The activities were also examined for lack of interest patterns. One thread that spanned both gender and grade levels was a general lack of interest in agricultural related activities. This finding is striking since these areas are relatively new to technology education. Additional work remains to be done to develop materials that will stimulate interest in this emerging area. Another general pattern that emerged was a lack of female interest in construction activities. While this is consistent with the literature, the finding indicates that developing engaging construction-related activities for females remains a significant challenge for curriculum developers (see Table 4). It is also useful to observe that the activities in this section tend to coincide with pedagogical strategies typically employed by the traditional academic disciplines (e.g., debate, research, evaluate). This suggests that the pedagogical approach may have a significant impact on student interest beyond the inherent interest in any particular activity.

Table 4
Activities Rated Least Interesting

Female preferences at middle school and high school levels	***n*** [*]
1. Debate the advantages and disadvantages of using pesticides in agriculture production.	164
2. Design a new use for an agricultural product.	156
3. Research why different materials are used to construct buildings in various areas of the world.	156
4. Evaluate the energy efficiency of your home.	148
5. In order to make a recommendation for a bridge, assess the environment in the area where a bridge is needed.	144
Male preferences at middle school and high school levels	
1. Assess the risks of genetically engineered plants.	241
2. Debate the advantages and disadvantages of using pesticides in agriculture production.	212
3. Research methods used to recycle plastics into reusable materials.	203
4. Make a simple working model of a stethoscope.	200
5. Maintain a green house to harvest food year round.	200

[*] *n* = the number of students who rated the activity either "not very interesting" or "not interesting at all"

Topic Preferences

The second major focus of the study was to explore patterns of student interest in technology education topics derived from the *STL*. This is important since the inherent interest in topics could differ from topic-related activities. Well developed activities can potentially engage students in topics that may be of little inherent interest. The study's design included both topics and activities in an attempt to explore these dynamics. This two-dimensional approach is also important because the technology education field has historically emphasized activities, often with a corresponding de-emphasis on content and conceptual development (Custer, 2003). In this respect, the *STL* represent significant progress in identifying an appropriate conceptual framework for the content of the field. Appropriate curriculum development must select and develop activities that will deliver and reinforce content rather than the other way around (Wiggins & McTighe, 1998). Thus, exploring student interest patterns for both topics and activities will begin to develop a base of information for curriculum developers. Teachers need to know which areas to emphasize as they select and develop activities.

A two-way factorial ANOVA was conducted to compare gender and grade level differences related to technological topics. At the composite level, significant differences were found between males and females, with males rating the topics significantly more interesting than females. Significant gender differences were also found with specific *STL* content areas including The Nature of Technology, Design, Abilities in a Technological World, and The Designed World, with the males rating the topics more interesting than females (see Table 5). These findings are generally consistent with cultural stereotypes, where males tend to be more interested in technology-related topics than females. It is interesting to note the lack of significant differences for the technology and society category. This is consistent with research indicating that females are interested in technology topics that are socially relevant (Caleb, 2000). No significant grade level differences were found across the major *STL* categories.

Table 5
Male and Female Interest Preferences Toward Content Standards

Activity Category (male n = 366, female n = 249)	**Mean** M	**Mean** F	**SD** M	**SD** F	p
Composite[a]	3.09	3.35	.91	.84	.001*
The Nature of Technology	3.24	3.59	.99	.91	.000*
Technology and Society	3.31	3.51	1.04	1.00	.067
Design	2.91	3.18	.97	.90	.001*
Abilities for a Technological World	3.05	3.33	.98	.97	.002*
The Designed World	2.94	3.16	.92	.88	.010*

Note. Lower numerical values indicate higher levels of interest and higher numerical values indicate lower levels of interest.
[a]Composite: comprised of responses toward all activities
* $p < .05$

The topics rated most interesting were compared by gender. A striking degree of similarity was found, with four of the top five topics receiving high ratings by both genders. The points of difference are consistent with the findings in the activities component of this study, with females indicating high interest in design and males indicating interest in repairing products (see Table 6). While females tend not to prefer utilizing types of activities (see Table 1) when compared to males, females rated two communications-oriented utilizing topics as most interesting. This is consistent with the literature, which indicates a female preference for communication and interpersonal interaction (Caleb, 2000). This has important implications for gender-balanced topic selection in technology education.

Table 6
Topics Rated Most Interesting

Female preferences at middle school and high school levels	n^*
1. Using computers to communicate	174
2. Cloning	150
3. How video materials are developed to communicate a message	140
4. Robotics	120
5. Characteristics of design	112
Male preferences at middle school and high school levels	
1. Robotics	247
2. Using computers to communicate	232
3. Cloning.	221
4. How to repair products	198
5. How video materials are developed to communicate a message	171

*n = the number of students who rated the topic either “very interesting” or “somewhat interesting”

Some interesting patterns emerged with respect to the topics rated as least interesting (see Table 7). Both genders were least interested in topics generally associated with ethical and societal values, which could signal a general lack of interest in these types of topics among middle and high school level students. At the same time, this finding is perplexing given the potential impact of technology on critical social issues such as genetic engineering, information technology privacy, global resource distribution, and national security, this finding is somewhat disturbing.

Table 7
Topics Rated Least Interesting

Female preferences at middle school and high school levels	n^*
1. The correct and safe use of tools and machines	161
2. How technology has improved agriculture	159
3. Ethical issues related to technology	154
4. How societal values and beliefs shape technology	139
5. How to reduce the use of nonrenewable energy resources	135
Male preferences at middle school and high school levels	
1. Ethical issues related to technology	195
2. How societal values and beliefs shape technology	188
3. How people decide to buy consumer goods	179
4. Ethical and social issues related to biotechnology	176
5. How technology has improved agriculture	176

*n = the number of students who rated the activity either “not very interesting” or “not interesting at all”

The general lack of interest in agricultural and biotechnology topics may be due to their relative newness in technology education. As the population demographics continue to shift from agricultural to urban areas, generating student interest in the agriculture-related topics may become increasingly challenging.

The pattern of topics rated least interesting by both genders is generally aligned with content that is somewhat new to the field and which may be perceived to be associated more with social studies topics than with technology. Given the importance of these ethical and resource distribution issues on a global scale, the field will need to find ways to generate additional student interest on these topics at a local or community level.

Instructional Approaches

The final component of the study focused on instructional approach preferences, which represents a third major element of the student preference complex (along with activity and topical preferences). As with most educational and behavioral science issues, student motivational and interest pattern dynamics are complex and multi-dimensional. Specific to gender-based student interest patterns in technology education, it is quite possible that engaging instructional approaches could stimulate student engagement with topics that previously held little interest. For this study, instructional approach data were gathered and analyzed in three different sets: general instructional approaches, activity-specific approaches, and instructional grouping preferences.

The rank order preference patterns for general instructional approaches were similar for males and females (see Table 8). Students who typically enroll in technology education classes are attracted to the types of projects that they will be engaged in, so it is not surprising that doing projects was ranked "1" by both genders. Somewhat inconsistent with research, however, was the high

Table 8
General Instructional Approaches

	Females		**Males**	
	Rank Sum	**Rank**	**Rank Sum**	**Rank**
Doing projects	641	1	939	1
Competitive Activities	888	2	988	2
Collaborative activities	1020	3	1349	4
Online learning	1063	4	1343	3
Debate	1090	5	1603	7
Stations in computer lab	1175	6	1464	5
Discussion	1200	7	1742	8
Independent study	1257	8	1588	6
Lecture with discussion	1614	9	2136	9
Lecture	1877	10	2458	10

ranking of competitive activities by females (preference #2). Research indicates that females are less interested in competitive activities than boys, preferring learning environments that nurture collaboration (Chapman, 2000; Fiore, 1999; Jacobs & Becker, 1997; McIntosh, 1983; Rosser, 1990; Sanders, Koch, & Urso, 1997).It is interesting that "online learning" and "stations at a computer lab" are ranked higher by females than "debate" and "discussion". This may have to do with the purpose of computer use. Females' interest increases if the computer is used as a tool to create something like a multimedia presentation, but not if the focus is on learning how to program computers (Brunner & Bennett, 1997, 1998). Consistent with the literature were the relatively low rankings of "debate" and "discussion" by the males (Welty & Puck, 2001). Also, both genders ranked "lecture" and "lecture with discussion" as the least preferred methods of instruction.

The rank order preferences toward activity-specific instructional approaches were essentially the same for both genders (see Table 9). Consistent with the literature, females ranked "exploring how well something works" as their least preferred approach; on the other hand, males' ranking it as their least preferred approach is inconsistent with literature (Welty & Puck, 2001).

Table 9
Activity-Specific Instructional Approaches

	Females		Males	
	Rank Sum	**Rank**	**Rank Sum**	**Rank**
Making a project	292	1	432	1
Learning how to operate or use something	555	2	703	2
Designing a solution to a given problem	624	3	818	3
Exploring how well something works	689	4	850	4

Table 10
Instructional Grouping Preferences

	Females		Males	
	Rank Sum	**Rank**	**Rank Sum**	**Rank**
Working with partners	386	1	539	1
Working in groups of three or more people	449	2	607	2
Working alone	619	3	758	3
Working together with the entire class	704	4	895	4

The rank order preferences of instructional groupings are the same regardless of gender or grade level (see Table 10), with both genders expressing a preference for small group work. This finding is generally consistent with the evolution in the field from the heavy traditional emphasis on individual projects to the contemporary emphasis on teamwork and group projects.

Implications and Discussion

The finding that contemporary technology education activities have similar appeal to both males and females is instructive. Even if the topics presented in the *STL* appear to be inherently more interesting to males, the selection and development of gender-balanced activities appears to overcome the differences in topical interest. While it may be extremely difficult to change cultural and gender-related stereotypes, it is possible that carefully selected and well-developed activities could stimulate female interest in topics about which they may have previously had little interest. This represents a positive challenge for curriculum developers.

A deliberate attempt was made to select activities for the instrument that would appeal to both middle and high school students. Consequently, it was somewhat surprising that middle school students rated the activities more appealing. One could speculate that technology educators are simply better at developing curriculum materials for the middle school than for the high school. Significant work remains to be done to conceptualize the discipline and its associated curriculum materials for high school students. This need is particularly pronounced at the advanced level, where the programs are quite diverse and where curriculum materials are scant and tend to be underdeveloped.

The extensive use of student competitions should be examined in more depth by the profession. While the findings of this research indicate support of competitions by females, this outcome contradicts previous research. Since technology education competitions tend to be conducted in teams, it could be that the collaborative aspects of the process enhance the appeal of competitions for females. It should also be noted that the participants in this study chose to elect technology education classes. Thus, the characteristics of these female "selectors" may differ from those who have not opted to take technology education classes. Regardless, given the emphasis on collaboration and the concerns about competition in the literature, this represents an important area of future research.

Females' preference for designing learning experiences and males' preference for utilizing learning experiences was consistent with gender stereotype research. Research indicates that females are more interested in design-oriented activities. This is particularly true when the design activities include a focus on problem solving or socially relevant issues. By contrast, particularly in traditional industrial arts classes, males have been attracted to a variety of building activities, which involved the use of machinery and tools. In many cases, traditional industrial arts activities have tended to de-emphasize the design aspects of making, with students often working from existing project plans. It is possible that the increased emphasis on design activities in contemporary technology education courses might provide some balance between designing and making/utilizing – which potentially makes technology education activities more appealing to both boys and girls.

The findings reflect that students are reluctant to expand their interests in content and activity types in the areas of agriculture, medicine and biotechnology. It could be that students who typically enroll in technology education classes have preconceived notions about the types of activities in which they will engage and that these expectations do not include medical, agricultural, and biotechnology related activities. This presents a challenge to curriculum developers who design activities in these new areas. Students' interest may increase if there are clear connections established between the skill and concept similarities in agriculture, medical, and biotechnology activities to activities found in familiar contextual areas. Additional research will be required to better understand these dynamics.

Recommendations for the Profession

Based on the findings, conclusions, and implications of this study, the following recommendations are suggested for future practice:

1. Additional research should be conducted to better understand the dynamics of student preferences for technology related topics, activities, and pedagogical approaches. Of particular importance is an understanding of the factors that are most important for female students.
2. Technology Education curriculum developers should intensify the use of research results of gender based studies to design and develop standards based activities that appeal to females. Particular attention should be placed on research conducted in the SMET areas of study (science, mathematics, engineering and technology).
3. The profession should invest substantial effort and resources into developing standards based curricula to deliver agricultural, biotechnology, and medical technologies with engaging and interesting activities. This will require collaborating with science teachers (particularly in biology and earth science).
4. The profession should invest significant effort into developing new resources focused on ethical and social issues consistent with the *Standards for Technological Literacy*. This is particularly important for technology teachers, many of whom have relatively little formal preparation in teaching social science oriented topics.
5. The profession should invest resources into conceptualizing and developing appropriate curriculum materials for upper level high school technology education programs. This is particularly important given the growing alliance with engineering.

6. The profession should invest in additional research identifying demographic preferences of students toward activities, topics, and instructional methods. Further refinement and use of the TIP and TAP inventories would assist curriculum designers in developing curriculum that is gender balanced.

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