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Measuring Artistically Gifted Students' Attitudes toward Technology Using Modified Fennema Sherman Attitudes Scales

Fennema Sherman Tutum Ölçekleri Kullanarak Sanatta Üstün Yetenekli Öğrencilerin Teknolojiye Karşı Tutumlarının Ölçülmesi

John A. Dantzler, Kevin D. Bensoy* & James A. Siders

Abstract

This study measured artistically gifted students' attitudes toward technology and compared them to their math/science peers. Researchers administered the English version of the Modified Fennema Sherman Attitudes Scales (M-FSAS) to 149 students enrolled at a residential school (grades 7 – 12) for the artistically and math/science gifted (108 female, 41 male). Analyses revealed no multivariate difference between arts concentrations; however, there was a statistically significant multivariate difference between math/science students and arts students. Further univariate analyses indicated statistically significant differences in all areas except in the gender differences subscale. Math/science students had lower M-FSAS scores, which equate to stronger attitudes surrounding technology. Results suggest that artistically gifted students do not perceive technology as being as relevant to their lives as their math/science gifted peers. For this artistically gifted sample, these results potentially represent fewer career opportunities and creative outlets. Based on these results, educators should imbed into the curriculum opportunities for artistically gifted students to utilize technology for career-oriented purposes.

Key Words: artistically gifted, attitudes toward technology

Öz

Araştırmada sanat alanında üstün yetenekli öğrencilerin teknolojiye karşı tutumları incelenmiş ve matematik ve fen alanlarındaki üstün yetenekli öğrencilerin tutumları ile karşılaştırılmıştır. Ölçme aracı olarak Fennema Sherman Tutumlar Ölçeği yatılı bir okula devam eden 108'i kız ve 41'i erkek olmak üzere sanatta ve matematik ve fen alanlarında üstün yetenekli toplam 149 öğrenciye uygulanmıştır (7. ve 12. sınıflar arası). Analizler sanat alanları arasında bir farkın olmadığını ancak sanat alanları ile matematik ve fen alanlarında üstün yetenekli öğrenciler arasında farkların olduğunu ortaya koymuştur. Matematik ve fen alanlarında yetenekli öğrenciler teknolojiye karşı daha güçlü tutumlar ortaya koymuşlardır. Matematik ve fende yetenekli öğrencilere kıyasla sanat alanında üstün yetenekli öğrenciler teknolojinin kendi yaşamları için çok ilgili olmadığını düşünmektedirler. Araştırma sonuçlarına göre teknolojinin sanatta üstün yetenekli öğrenciler için daha az kariyer fırsatları sunduğu söylenebilir. Araştırma bulgularına göre, sanatta üstün yetenekli öğrenciler için kariyer olanakları sağlayabilecek teknoloji entegrasyonun eğitimlerine uyarlanması önerilebilir.

Anahtar Sözcükler: Sanatta üstün yetenekli öğrenciler, teknolojiye karşı tutumlar

Introduction

An assumption that today's gifted students are savvy technology users innately capable of innovative tasks with any digital device may be an over generalization. For over a decade now,

* *Correspondence Author, The University of Alabama, Tuscaloosa, USA; kdbesnoy@bamaed.ua.edu*

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the term 'digital native' (Prensky, 2001) has provided educators with a catchy phrase to describe a new generation of students who require, and thrive on, access to technology tools for learning and social purposes. The digital technology revolution is a captivating, and convenient justification for a shift in students' motivational levels to learn. At first glance, many gifted youth around the globe appear to have an irresistible attraction to technology and the myriad of applications inherent to these devices. In contrast, Prensky's term 'digital immigrant' has been used to classify a generational group of teachers who came of age before the currently technology revolution phase. The use of these two phrases serves as a generational line of demarcation and an oversimplification of current technology integration practices.

While many gifted young people have a propensity towards manipulating technology gadgets, their natural interest does not mean they automatically recognize how to use these tools for career-oriented purposes (Kirschner & Merriënboer, 2013). In fact, Eshet-Alkalai and Chajut (2010) asserted, "…technical control of a digital environment does not ensure educated use" (p. 179). Given the infusion of technology into everyday life, as well as the perceived intuitive attraction of youth toward technology, some educators and researchers have been too quick to assume gifted learners naturally recognize technology's relevance to the workplace. Understanding the distinction among technology use as a learning resource, teaching tool, and production medium is critical to developing gifted young people's precocious abilities.

Acquisition of 21st century, technology skills are as important for artistically gifted students as any other population. In fact, acquiring these abilities potentially opens many career opportunities that might otherwise be closed. VanTassel-Baska (2005) maintains that developing domain specific giftedness into marketable skills requires a great deal of time devoted to crafting a particular skill set. In order to fully develop these skills, Choi and Piro (2009) assert that artistically gifted students need explicit training on connecting technology, art, and career-readiness. While most artistically gifted students will not become artistic stars, there are plenty of career avenues for them outside art-related fields (e.g., engineering, management, sales, or health care) to pursue.

Effectively integrating technology into the art curriculum demands that educators take a process-oriented approach to develop students' career readiness skills. Researchers (Besnoy, Dantzler, & Siders, 2012; Black & Browning, 2011; Delacruz, 2004; Gregory, 2009; Sabol, 2010; Stankiewicz, 2004; Tillander, 2011) observed that a majority of jobs in contemporary economies required employees capable of technology-productivity and mastering those skills was fundamental for gainful employment. To meet this demand, researchers and practitioners have published pedagogical approaches that fused technology with art curricula. Their research concluded that technology-rich arts curricula produced more dynamic, relevant classroom instruction. This initiative has helped classroom teachers create learning environments whereby artistically gifted students can develop and merge their technology and artistic skill sets.

Some researchers (O'Brien, Friedman-Nimz, Lacey, & Denson, 2005; Siegle, 2004) report that new technology-gifted constructs are emerging. Preliminary findings from those studies suggest the presence of measurable technology-giftedness characteristics such as (a) an early acquisition of technology skills; (b) a keen interest in engaging with technology; (c) an ability to mentor others in technology use; (d) a capacity to transfer technology skills across platforms; and (e) an innate talent to produce complex products with technology. Given the promise and potential impact of these studies, researchers interested in promoting this particular area should continue to explore questions that refine the characteristics of the technology-giftedness construct.

Those findings, however, do not conclude technology use by or attitudes of gifted students whose precocious abilities fall outside the technology-gifted domain. The purpose of this research study is to address this gap in the literature. Three research questions guided this study: (a) What are gifted, secondary level arts students' attitudes toward technology?, (b) Are attitudes similar across art concentrations?, and (c) Is there a difference between gifted arts students' attitudes and gifted math and science students' attitudes toward technology? A better understanding of these attitudes may inform the future development of arts curricula regarding technology use.

Hybridization of Artistic Abilities and Technology

The hybridization of artistic and technological abilities has been discussed in the literature. Teachers of the artistically gifted must highlight the technology, art, and career-readiness connection in order to ensure students are adequately prepared to transfer their technology skills to future, unknown vocations. Tillander (2011) reported that the melding of creativity cognitive domains and information technology metacognitive skills have produce a new art-technology skill set rewarding digital innovation. Students capable of defining new innovative solutions for a technology-dependent society will be uniquely positioned to meet 21st century market place needs. Over a decade ago, Ash (2000) asserted, "…if we [art educators] are in the business of planning or equipping students for the 21st century, we should be using the tools and machinery which will drive it" (p. 85). Since that time, art educators (Black & Browning, 2011; Cress, 2013; Gregory, 2009; Hostert, 2010) have described ways to modernize art curricula through technology integration. Even the most gifted art student can be left behind if s/he does not possess certain skills and attitudes to be successful in contemporary, technology driven culture.

In 2013, the Strategic National Arts Alumni Project (SNAAP) surveyed 13,581 arts alumni from 154 post arts institutions (8 high schools, 236 post-secondary institutions) to identify art-to-artistic career connections. Forty-one percent of respondents were currently working as a professional artist; 43% are currently not working as a professional artist; and 16% never worked as a professional artist. The survey asked participants to indicate which skills have been important to their success in their professional life. Ninety-three percent indicated that technology skills and competencies were important in their professional work life. Results from the

SNAAP (2013) survey demonstrate the need for artistically gifted students, have a positive attitude toward technology, recognize technology's relevancy to their future earning potential, to acquire technology skills. The 59% of arts alumni not currently working in an arts related profession highlights this conclusion. Efforts to capitalize on artistic domain-specific talents might be more effective if they evolve out of a pedagogical shift from teacher as a technology tool user to one of a technology tool enabler. Empowering artistically gifted students with technology learning tools might hybridize highly desired artistic abilities and technology skills and reinforce the technology's critical role in future market places.

Attitudes toward Technology

Attitudes toward technology, like most other things, are formed as a result of one's belief of an attribute's importance to one's life. Researchers (Ajzen, 1991; Pajares, 1992; Sadaf, Newby, & Ertmer, 2012) proposed that beliefs are formed by the outcomes of experiences with a situation or object, falling into one or more of the following categories: (a) behavioral – result of the experience, (b) normative – expectation that the results will consistency occur, or (c) control – possessing skill set or resources to regulate the outcome. Combinations of these beliefs (i.e., clusters of beliefs) ultimately form attitudes about a particular situation or object. Thus, when using a survey to describe artistically gifted students attitudes toward technology, it represents the sum of their clusters of belief that technology plays an important role in their current and future lives.

It is often taken for granted that current state-of-art technologies will be outmoded and discarded tomorrow. In order for today's artistically gifted students to adapt to new technologies, they must have positive attitudes toward and see the relevancy of current technology tools. Presently, there is a dearth of empirical studies describing artistically gifted students' attitudes toward technology, which suggest a void in our understanding. Evidence that does exist indicates that artistically gifted students' non-academic lives and technology have bonded (Cress, 2013). Academically speaking, a few studies demonstrated that students are more engaged, creative, expressive, introspective, and innovative when using technology for collaborative and problem solving purposes (Black & Browning, 2011; Gregory, 2009; Stankiewicz, 2004; Tillander, 2011). It appears as though results of a decade-long advocacy campaign integrating technology into the art curriculum have made some pedagogical impact; however sample sizes are too small to draw any conclusive generalizations. As future studies are conducted, perhaps more definitive answers will be determined. In the meantime, it is unavoidable that openness to learning new technologies and willingness to continue adapting them to changing conditions are valuable attitudes for all future workers.

An individual's readiness to utilize technology to compete in the global marketplace is determined by the confluence of several factors, with attitude being just one. In fact, Author (in press) theorized a total of five factors (e.g., Support, Resources, Prior Learning, Natural Ability, and Attitude) that determine a student's readiness. It's the convergence of these factors that determines an individual's readiness to utilize technology in a process-oriented environment that yields creative-productivity. The impact that attitude has on gifted students use of technology has not yet been explored in literature.

To date, researchers have not investigated how, or if, identified gifted students (across all domains) are utilizing technology in combination with their precocious abilities. Furthermore, determining if gifted students learn with technology differently from non-gifted peers is unknown. A line of inquiry that addresses this gap in the research might allow the field of gifted education to better prepare gifted students to compete in the global marketplace. According to researchers (Besnoy, et al., 2012; Palak & Walls, 2009) documenting the hybridization of gifted abilities and technology might yield theoretical models that enable teachers of the gifted to create and sustain student-centered, digital ecosystems. Studying this developmental track is an iterative process that must proceed in a methodical manner.

Method

Participants and Setting

Participants were 149 high school students (108 female, 41 male) were enrolled in a residential public school for the fine arts. Students attending this school have the option of pursuing one of six curriculum strands: (a) Dance, (b) Music, (c) Creative Writing, (d) Theatre Arts, (e) Visual Arts, or (f) Math & Science. School admission for one of the five arts curriculum strands was based upon a selective audition and/or interview process for all students. Each candidate was evaluated in three areas: program audition, academic profile, and student maturity. Essays, recommendations, and personal interviews were used to determine student maturity (B. Hill, personal communication, December, 2011), Those who entered the Math/Science strand were admitted based on test scores, interviews, academic profile, teacher recommendations, and an essay.

A total of 149 students out of the population of 320 completed the instrument for a 46.6% completion rate. The sample population contained more participants enrolled in one of the six Arts (n = 98) concentration than Math and Sciences centration (n = 51). Additionally, there were more females (n = 108) than males (n = 41). Comparison between the sample population and the school's total population was conducted to ensure that participants of this study were representative of total school's population. Analyses revealed no statistically significant difference in terms of grade, $\chi^2(5)=2.30$, $p=.81$, gender, $\chi^2(1)=1.69$, $p=.19$, concentration, $\chi^2(5)=10.77$, $p=.06$, or domain area, $\chi^2(1)=2.77$, $p=.10$ (Table 1).

Table 1. Sample population and demographic statistics

	Sample		Population		X^2	*p*
	N	%	N	%		
Concentration						
Dance	16	10.7	31	9.7	10.77	.06
Music	25	16.8	65	20.3		
Creative Writing	27	18.1	42	13.1		
Theater Arts	17	11.4	42	13.1		
Visual Arts	13	8.7	50	15.6		
Math and Sciences	51	34.2	90	28.1		
Major Area						
Arts	98	65.8	230	71.9	2.77	.10
Math and Sciences	51	34.2	90	28.1		
Grade						
7th Grade	11	7.4	24	7.5	2.30	.81
8th Grade	24	16.1	47	14.7		
9th Grade	28	18.8	60	18.8		
10th Grade	30	20.1	59	18.5		
11th Grade	24	16.1	67	20.9		
12th Grade	32	21.5	63	19.7		
Gender						
Male	41	27.5	104	32.5	1.69	.19
Female	108	72.5	216	67.5		

Regardless of their selected curriculum strand, all students complete a core curriculum that meets this particular state's high school graduation requirements. Graduation requirements stipulate that all students complete 4-units in English, Social Studies, Mathematics, and Science. Additionally, a 1.5-unit Fine Arts and Health requirement and a .5-unit in Computer Application must be satisfied. Finally, all students received at least three hours of daily instruction in their chosen specialty.

Instrument

Researchers conducted a search of the literature to identify a survey fit the purposes of the current study. After an extensive search, researchers identified the Modified Fennema-Sherman Attitudes Scales (M-FSAS) (Kahveci, 2010) as the only survey that had been normed with a population of gifted students. As such, researchers administered the M-FSAS in order to measure participants' self-reported attitude toward technology (see Appendix A). In order to develop a scale to measure students' attitudes toward using technology for learning, their perception of technology's relevancy to current their lives, and connection a future workplace skillset, Kahveci (2010) modified the Fennema-Sharman's Mathematics Attitude Scale (FSMAS) (Fennema & Sherman, 1976). The original scale (FSMAS) measured student's self-reported attitudes toward and abilities in mathematics; therefore, Kahveci (2010) adjusted language to sensitize relationship between attitudes and technology.

According to Kahveci (2010) the modified FSAS instrument was developed in three stages. Initially five language and mathematics experts independently translated the FSMAS into Turkish. A follow-up consensus meeting was held to craft the instrument's final form. The experts replaced "mathematics" with "technology" and adjusted the questions to sensitize the questions toward the relationship between attitudes and technology. They produced Turkish and English language versions. Second, the experts then reviewed the items for content validity. Any item that the group deemed as irrelevant to using technology for learning purposes was removed completely. Third, the instrument was administered to high school students (n = 158) enrolled at a boarding school for gifted students in Istanbul, Turkey. Kahveci conducted a principle components exploratory factor analysis with varimax rotation which yielded an eight-factor solution explaining 65.6% of the total variance in the instrument. The eight subscales in M-FSAS are: (1) Relevance, (2) Satisfaction, (3) Confidence, (4) Gender Differences, (5) Personal Ability, (6) Social Influence, (7) Interest, and (8) Perseverance. Cronbach's alpha for each of the M-FSAS subscales was high: Relevance (.92), Satisfaction (.94), Confidence (.92), Gender Differences (.90), Personal Ability (.89), Social Influence (.81), Interest (.84), and Perseverance (.77). The overall instrument internal consistency estimate using Cronbach's alpha was .77, which indicated the instrument displayed strong evidence of reliability.

All of the 57-items on the M-FSAS were written as statements and participants were asked to indicate the degree to which they agreed or disagreed on a Likert-type scale (1 = Strongly Agree; 2 = Sort of Agree; 3 = Not Sure; 4 = Sort of Disagree; 5 = Strongly Disagree). Students who respond with lower scores are viewed as having more positive attitudes toward learning with technology, and greater perceptions that technology is relevant to their lives. Of the 156 students who participated in the Kahveci validation study, 48.1% (n = 75) concentrated in Science and

Mathematics; 27.6% (n = 43) focused in Mathematics and Social Science; and 24.4% (n = 43) were undecided. Finally, 43% (n = 68) of the validation sample were female and 57% (n = 90) were male.

Based on his findings, Kahveci (2010) concluded that students in the Turkish sample, regardless of academic concentration or gender, had positive attitudes toward learning with technology, and felt that technology was relevant to their lives. While all the populations responded positively to technology, Kahveci reported that students who focused on science and math were significantly more positive than their social sciences peers. "Perhaps students in social science fields do not get enough practice of technology applications for their learning as much as the other group. Hence, their perceptions about the usefulness of technology for learning may not be as developed" (Kahveci, 2010, p. 199). There were no artistically gifted students in the Turkish sample.

Current Study's Procedures

Researchers reviewed Kahveci's (2010) English version of the M-FSAS that appeared in *The Turkish Online Journal of Educational Technology*. In that article, Kahveci provided Turkish and English language versions of the M-FSAS. In order to prepare the survey for an English speaking population and to ensure more reliable results, researchers identified questions that were awkwardly translated and reworded them.

Recruitment for the current study began by distributing consent forms to all parents/guardians (n = 320) of students enrolled at the school. The consent forms stated the nature of the study and asked permission to allow their child to participate in the study. They were allowed two weeks to return the consent form. After two weeks, a follow up letter was sent home to families not returning the consent form. At that time, nonrespondents as well as those that replied, but indicated they did not want their child to participate in the study were removed from the sample.

The M-FSAS was administered during the school's regularly scheduled homeroom period. Daily schedules include two, separate 30-minute homeroom periods. Given the sample's status as digital natives, researchers intentionally did not attempt to define technology, thus allowing participants' responses to be filtered through their own personal experiences. During the first period, 7th – 9th graders are in homeroom and the 10th – 12th graders are on an instructional break. The two groups switched after the first 30-minute period. During the two separate homeroom periods, participants in the sample gathered in a large auditorium and completed the survey. The primary investigator administered the M-FSAS during the two-30-minute homeroom periods. After participants completed the survey, researchers entered the data into *SPSS* (*Software Package for Statistics and Simulation*), a software package commonly used for statistical analysis.

Results

Fifteen of the 149 students who completed the instrument had missing data; therefore, data from 134 students were retained for analysis. Ninety-two (68.7%) of the students were from one of the five arts concentration with forty-two (31.3%) from the math and science domain. Females (74.6%) were more highly represented than males (25.4%) overall, and differences in the distribution of males and females between the arts and math/sciences groups existed, $\chi^2(1)=5.23$, $p=.02$. The arts group had a greater proportion of female respondents than the math group. There was no difference between concentration groups in the distribution of grade level, $\chi^2(1)=1.75$, $p=.19$. Overall, 76.1% of the respondents were in the high school grades (9-12) and 23.9% were in the middle school grades (7-8) (see Table 2, for Respondent Demographics).

Table 2. Demographics of the sample used for analysis.

Group	Gender		Grade Level		Total
	Male	Female	Middle	High	
	n (%)	n (%)	n (%)	n (%)	n (%)
Math & Sciences	16 (38.1)	26 (61.9)	7 (16.7)	35 (83.3)	42 (31.3)
Arts	18 (19.6)	24 (80.4)	25 (27.2)	67 (72.8)	92 (68.7)
Total	34 (25.4)	100 (74.6)	32 (23.9)	102 (76.1)	134 (100)
	$\chi^2(1)=5.23$, $p=.02$		$\chi^2(1)=1.75$, $p=.19$		

Descriptive Analyses

For purposes of this research, all eight subscales on the M-FSAS were identified as scales of interest: Personal Ability, Perseverance, Satisfaction, Confidence, Interest, Relevance, Gender Differences and Social Influence. These eight subscales support previous research (Ajzen, 1991; Pajares, 1992; Sadaf, Newby, & Ertmer, 2012) describing that attitudes are formed as a result of experiences with a situation or object. For purposes of this study, these eight subscales quantitatively measure this population's experiences with technology, thus indicating their attitude toward technology. Cronbach alpha reliability analysis indicated that for this sample, there was high internal consistency with an alpha of .95 for the total scale. The Relevance (◎=.90), Satisfaction (◎=.90), Confidence (◎=..87), Gender Differences (◎=.86), Personal Ability (◎=.88), Social Influence (◎=.77), and Interest (◎=.81) subscales all displayed very high internal consistency. Perseverance (◎=.55) was the one subscale that had marginal internal consistency. Scores on three of the eight subscales were significantly positively skewed, suggesting that the sample self-described positive attitude on these three subscales. Personal Ability, Satisfaction, and Relevance all had standardized skew values above 2.58 indicating highly skewed distributions (see Table 3, for Descriptive statistics).

Table 3. Descriptive statistics

	M		SEM		*S*		Skew		*Z* Skew	
	M/S (n=42)	*Arts (n=92)*	*M/S*	*Arts*	*M/S*	*Arts*	*M/S*	*Arts*	*M/S*	*Arts*
Personal Ability	24.5	30.5	1.49	0.99	9.66	9.49	1.76	0.93	4.82*	3.71*
Perseverance	11.0	12.1	0.52	0.30	3.37	2.90	0.24	0.17	0.66	0.68
Satisfaction	10.2	13.9	0.63	0.65	4.06	6.20	1.21	1.18	3.32*	4.70*
Confidence	21.1	27.2	1.06	0.75	6.87	7.21	0.33	0.42	0.90	1.67
Interest	8.6	11.5	0.59	0.41	3.83	3.90	0.64	0.15	1.75	0.60
Relevance	24.5	30.5	1.49	0.99	9.66	9.49	1.76	0.93	4.82*	3.71*
Social Influence	9.1	10.6	0.47	0.44	3.08	4.20	1.94	1.40	0.37	0.25
Gender Diff.	11.5	12.3	0.75	0.61	4.87	5.88	2.16	2.45	0.72	0.25

Note: * $p<.001$. Math & Sciences n = 42, Arts n = 92. SE Skew M/S=.365, Arts=.251

The data on each of the eight subscales were transformed using a log transformation procedure. While only three of the eight subscales were highly positively skewed, all subscales were subjected to transformation in order to enhance cross-subscale comparisons. Arts students identified as being a member of one of five arts concentrations; creative writing, dance, theatre arts, music, or visual arts. A multivariate analysis of variance indicated that there was no multivariate difference between students' attitudes toward technology on any of the subscales based on arts concentration, Λ=0.64, $F(28,293.4)=1.34$, $p=.09$, $\eta^2=.11$.

The eight subscales were analyzed for differences between domains (arts or math/science). A multivariate analysis of variance was conducted to adjust for family wise error, and a natural log transformation was conducted for each subscale prior to analysis to address the non-normality of the subscales scores (Field, 2009). A significant multivariate effect indicated differences among some of the subscales between math & sciences and arts students, Λ=0.22, $F(7,126)=5.06$, $p<.001$, $\eta^2=.21$. Univariate analyses indicated that significant group differences were evident on seven of the eight transformed subscales. Personal ability [$F(1,132)=15.66$, $p=.001$, $\eta^2=.11$], Perseverance [$F(1,132)=4.46$, $p=.04.$, $\eta^2=.03$], Satisfaction [$F(1,132)=14.86$, $p=.001$, $\eta^2=.10$], Confidence [$F(1,132)=24.99$, $p<.001$, $\eta^2=.16$], Interest [$F(1,132)=19.02$, $p<.001$, $\eta^2=.13$], Relevance [$F(1,132)=15.66$, $p=.001$, $\eta^2=.11$], and Social Influence [$F(1,132)=4.17$, $p=.04$, $\eta^2=.03$] generated F ratios that were statistically significant at the .05 alpha level. For each of these statistically significant subscales, children in the math and sciences concentration held higher levels of confidence in their abilities than those in the arts concentration (see Table 4, for ANOVA Results). However, there was no statistically significant difference between the transformed scores in Gender Differences between the two groups [$F(1,132)=0.72$, $p=.40$, $\eta^2=.01$].

Table 5. Subscale ANOVA Results Between Domains

	M lg10 (*SE*)		*SS*		*MS*		*F*	η^2	*p*
	M&S (*n*=42)	*Arts* (*n*=92)	*Group*	*Error*	*Group*	*Error*			
Personal Ability	1.36 (.02)	1.46 (.01)	0.29	2.47	0.29	0.02	15.66	.11	<.001
Perseverance	1.02 (.02)	1.07 (.01)	0.07	1.95	0.07	0.02	4.46	.03	.04
Satisfaction	0.98 (.03)	1.11 (.02)	0.44	3.92	0.44	0.03	14.86	.10	<.001
Confidence	1.30 (.02)	1.42 (.01)	0.41	2.15	0.41	0.02	24.99	.16	<.001
Interest	0.90 (.03)	1.04 (.02)	0.56	3.89	0.56	0.03	19.02	.13	<.001
Relevance	1.36 (.02)	1.46 (.01)	0.29	2.47	0.29	0.02	15.66	.11	<.001
Social Influence	0.94 (.02)	1.00 (.02)	0.09	2.95	0.09	0.02	4.17	.03	.04
Gender Differences	1.03 (.02)	1.06 (.02)	0.02	3.28	0.02	0.03	0.72	.01	.40

Note: Λ=0.22, $F(7,126)=5.06$, $p<.001$, $\eta^2=.22$. Univariate df=1,132

Table 4. Subscale ANOVA results between arts concentrations

	M lg10 (*SE*)					*SS*		*MS*		*F*	η^2	*p*
	Creative Writing (n=25)	*Dance (n=15)*	*Theatre Arts (n=16)*	*Music (n=23)*	*Visual Arts (n=13)*	*Group*	*Error*	*Group*	*Error*			
Personal Ability	1.46 (.03)	1.50 (.03)	1.42 (.03)	1.44 (.03)	1.53 (.04)	0.13	1.45	0.03	0.02	1.88	.08	.12
Perseverance	1.05 (.02)	1.11 (.02)	1.09 (.03)	1.06 (.02)	1.07 (.03)	0.04	1.07	0.01	0.01	0.86	.04	.49
Satisfaction	1.13 (.04)	1.12 (.06)	1.08 (.04)	1.06 (.03)	1.16 (.05)	0.11	2.87	0.03	0.03	0.83	.04	.51
Confidence	1.40 (.02)	1.49 (.02)	1.44 (.04)	1.40 (.03)	1.41 (.03)	0.10	1.16	0.03	0.01	1.92	.08	.12
Interest	1.00 (.03)	1.13 (.04)	1.01 (.04)	1.02 (.03)	1.04 (.06)	0.19	2.17	0.05	0.03	1.89	.08	.12
Relevance	1.46 (.03)	1.50 (.03)	1.42 (.03)	1.44 (.03)	1.53 (.04)	0.13	1.45	0.03	0.02	1.88	.08	.12
Social Influence	1.03 (.04)	0.99 (.04)	0.90 (.03)	1.00 (.03)	1.04 (.03)	0.20	2.08	0.05	0.02	2.12	.09	.09
Gender Differences	1.02 (.03)	1.09 (.04)	0.99 (.03)	1.10 (.04)	1.09 (.05)	0.16	2.20	0.04	0.03	1.62	.07	.18

Note: Λ=0.64, F(28,293.4)=1.34, p=.09, η^2=.11. Univariate df=4,87

Discussion

This study's results contribute to the literature describing the integration of technology into art curricula. These findings report this sample of artistically gifted students' attitudes toward technology and compare them to the attitudes of their math/science gifted peers. The results support previous research (Cress, 2013) that artistically gifted students have had positive experiences with technology and generally view technology as a natural part of their lives. However, when compared to their math/science peers, artistically gifted students have less favorable attitudes about technology's relevancy in their future lives. Considering the art education field's literature describing technology integration best practices, researchers were surprised to find these differences.

Attitude toward Technology

There is scant research on the overall population of gifted students' attitudes toward technology; yet, the larger body of evidence suggests that there some gifted students who might have a natural inclination and willingness to use technology for academic and social purposes (O'Brien et al., 2005; Siegle, 2004, 2009). Results of this current study seem to support this notion but the sample population was too small to general conclusions beyond this study. At the same time, there is some question as to the whether 'digital natives' learn differently than their 'digital immigrant' peers (Eshet-Alkalai & Chajut, 2010; Kirschner & Merriënboer, 2013). It is still unclear if their lifelong exposure to correlates to actual skills needed in the workplace.

While the sample's self-reported data is normally distributed on the Perseverance, Confidence, Interest, Social Influence, and Gender Differences subscales, means for Personal Ability, Satisfaction, and Relevance are positively skewed. Overall, students in this sample have positive attitudes toward using technology for academic and non-academic purposes. Additionally, they believe that there are social benefits to using technology and that technology skills are not gender specific. Finally, the positively skewed means indicate that students in this sample have a heightened sense of personal ability and satisfaction to use technology for academic as well as non-academic purposes.

A possible explanation for this finding may be lifelong exposure to technology (Cress, 2013; Prensky, 2001, 2009) unique to this generation. If technology has become as commonplace in their lives as Prensky (2001, 2009) described, then it appears as though they would have an overall favorable view of their technology abilities. Questions on the M-FSAS measured students' attitudes toward technology. Since the instrument only relies on self-reported data, it is not known if students' perceptions of their experiences with technology are an accurate reflection or an overestimation. These results, however, should be viewed within the limited context where they were gathered and not generalized to a larger population. Future data on gifted students' attitudes toward technology, which should ultimately be compared to larger samples of gifted and non-gifted students.

Between Groups Comparisons

Given the paucity of research detailing gifted students' attitudes toward technology, results from the between groups comparisons add to the field's overall body of knowledge. In analyzing these results of this study, it is important to keep in mind that artistically gifted students' means have normal or positively skewed distributions. The significant group differences on all the subscales indicate that artistically gifted students in this sample do not have as positive attitudes toward technology and do not see technology as relevant to their current or future lives as their math/science gifted peers. This finding seems to support the conclusions by Kirschner & Merriënboer (2013) that 'digital natives' do not have an innate technology skills simply because they only know a world where digital tools are common place. As SNAAP (2011) reports, many artistically gifted students will be competing with other gifted students for careers outside the arts. As such, they require a technology skill set and high confidence levels to successfully compete for positions in the 21st century marketplace. A

In light of the decade long advocacy efforts by art-educators (Black & Browning, 2011; Cress, 2013; Goldberg, 2006; Gregory, 2009; Stankiewicz, 2004; Tillander, 2011), researchers were surprised by the between group comparisons. One possible explanation for these lower levels may be a result of artistically gifted students not registering for technology focused elective courses. Artistically gifted students' lack of exposure to these types of enrichment courses would limit their opportunity to gain valuable technology experience and could possibly explain these results. This conclusion is supported by previous research (Duncan 1997; Eshet-Alkalai & Chajut, 2010) demonstrating the need to purposefully teach digital natives how to use technology for sophisticated purposes.

Another possible explanation for these lower levels may be that researchers did not attempt define technology when administering the survey. As such, researchers are not certain as to how participants might have interpreted the term in their responses. Without better understanding of how the students who participated in this study understood technology, it is difficult to generalize that current attitudes toward technology are likely to hinder gifted art students from getting jobs that require use of newer digital devices.

Limitations

There were a few limitations with this current study that inhibited interpretation and generalization of these findings. First, participants completed the English version of the M-FSAS, which was validated for a Turkish population of gifted students. As such, generalizations drawn from these results should be made with caution. However, there are currently no instruments that measure gifted students' attitudes toward technology. Validating such an instrument will allow for greater analysis and more accurate generalizations. Second, there are no other American populations, gifted or non-gifted, with which to compare these results. We are only at the beginning of this line of inquiry. Thus, it is difficult to determine if gifted students' attitudes toward technology is any different than their non-gifted peers.

Conclusion

The field of gifted education needs to investigate root differences between 'digital natives' and 'digital immigrants'. The field must begin developing theoretical models that guide teachers of the gifted as they create technology rich learning environments. Researchers need to conduct a series of empirical studies that seek to determine if gifted students have natural state of technological proficiency to using technology for creative-productive purposes.

Future efforts built upon this study should include refinement and continued validation of the M-FSAS (Kahveci, 2010) to more accurately distill learner attitudes and interests while more precisely examining the various avenues within the arts. Emergent technologies will also need to be accounted for with the revision of the M-FSAS to remain relevant when matching learner skill and aptitude with devices, applications, and curricula designs. Rather than researchers defining technology for participants and then measuring their attitudes, it is important to allow participants to define technology and then determine how it is relevant to their lives.

Public education is responsible for the civil integration of children and youth into society and the job force. Too often educators and society in general operate under the premise that learners possessing gifts such as math, science, and in the instance of this study, art, will flourish independently in and out of instructional settings. Adolescents and young adults gifted in the arts depend on the convergence of a curriculum in the arts with opportunities and deliberate delivery of technology use and application. Technology use has become increasingly transparent to all users, but in order to transfer them into the workplace, a direct and sustained initiative must be fundamental to curricula serving the artistically gifted.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179–211.

Ash, A. (2000). Bite the ICT Bullet: Using the World Wide Web in Art Education. In R. Hickman (Ed.), *Art Education 11-18* (pp. 83-96). New York, NY: Continuum.

Author (in press – fall 2014). Creating a Sustainable Digital Ecosystem for the Gifted Education Classroom. In F. A. Karnes & S. Bean (Eds.). *Methods and Materials for Teaching the Gifted (4th edition).* Waco, TX: Prufrock Press, Inc.

Besnoy, K. D., Dantzler, J., & Siders, J. A. (2012). Creating a digital ecosystem for the gifted education classroom. *Journal for Advanced Academics, 23*(4), 1-21.

Black, J. & Browining, K. (2011). Creativity in digital art education teaching practices. *Art Education, 64*(5), 19-34.

Choi, H., & Piro, J. (2009). Expanding arts education in a digital age. *Arts Education Policy Review, 110*(3), 27-34.

Cress, S. (2013). The digital doimain: Using today's technologies to inspire engaging classroom experiences. *Art Education, 66*(1), 40-45.

Delacruz, E. M. (2009). Art education aims in the age of new media: Moving toward a global civil society. *Art Education, 62*(5), 13-18.

Duncan, P. (1997). Art education for new times. *Studies in Art Education, 38*(2) 69-79.

Eshet-Alkalai, Y., & Chajut, E. (2010). You can teach old dogs new tricks: The factors that affect changes over time in digital literacy. *Journal of Information Technology Education, 9*(3), 173-181.

Fennema, E., & Sherman, J. A. (1976). Fennema-Sherman mathematics attitude scales. Instruments designed to measure the attitudes toward the learning of mathematics by females and males. JSAS: Catalog of Selected Documents in Psychology, 6(Ms. No. 1225), 31 Field, A. (2009). *Discovering statistics using SPSS: Introducing statistical methods (3rd edition).* Thousand Oaks, CA: SAGE Publications Ltd.

Goldberg, M. (2006). *Integrating the Arts: An Approach to Teaching and Learning in Multicultural and Multilingual Settings.* New York, NY: Pearson

Gregory, D. (2009). Boxes with fires: Wisely integrating learning technologies into the art classroom. *Art Education, 62*(3), 47-54.

Hostert, N. (2010). Uncommon dialogue: digital critique beyond the art classroom. In R.W. Sweeny (Ed.), *Interactions intersections: Art education in a digital visual culture* (pp. 90-96). Reston, VA: National Art Education Association.

Kahveci, M. (2010). Students' perceptions to use technology for learning: Measurement integrity of the modified Fennema Sherman attitudes scales. *The Turkish Online Journal of Educational Technology, 9*(1), 185-201. Retrieved from http://20. 132.48.254/PDFS/EJ875782.pdf.

Kirschner, P. A., & van Merriënboer, J. J. G. (2013). Do Learners Really Know Best? Urban Legends in Education. *Educational Psychologist*, *48*(3), 169-183.

O'Brien, B., Friedman-Nimz, R., Lacey, J., & Denson, D. (2005). From bits and bytes to C++ and Web sites: What is computer talent made of? *Gifted Child Today, 28*(3), 56–63.

Palak, D., & Walls, R. T. (2009). Teachers' beliefs and technology practices: A mixed-methods approach. *Journal of Research on Technology in Education, 41*(4), 417-441.

Pajares, M. F. (1992). Teachers' beliefs and educational research: cleaning up a messy construct. *Review of Educational Research, 62*(3), 307-332.

Prensky, M. (2001). Digital natives and digital immigrants. *On the Horizon, 9*(5), 1–7.

Prensky, M. (2009). H. Sapiens digital: From immigrants and digital natives to digital wisdom. *Innovate: Journal of Online Education, 5*(3), 9.

Sabol, F. R. (2010). *No Child Left Behind: A Study of Its Impact on Arts Education.* Supported by a Grant for the National Art Education Foundation. Purdue University, West Lafayette.

Sadaf, A., Newby, T. J., Ertmer, P. A. (2012). Explorin pre-service teachers' beliefs about using web 2.0 technologies in K-12 classrooms. *Computers in Education, 59*, 937-945.

Siegle, D. (2004). Identifying students with gifts and talents in technology. *Gifted Child Today, 27*(4), 30-33, 64.

Siegle, D. (2009). Literacy in the 21st century: The fourth R-Video Recording. *Gifted Child Today*, 32(2), 14-19.

Stankiewicz, M. A. (2004). Notions of technology and visual literacy. *Studies in Art Education: A Journal of Issues and Research, 46*(1), 88-91.

Strategic National Arts Alumni Project (SNAAP) (2013). *Forks in the Road: The Many Paths of Arts Alumni.* Retrieved from http://snaap.indiana.edu/pdf/2013/SNAAP Annual Report 2013.pdf.

Tillander, M. (2011). Creativity, technology, art, and pedagogical practices. *Art Education, 64*(1), 40-46.

VanTassel-Baska, J. (2005). Domain-Specific Giftedness: Applications in School and Life. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of Giftedness (2nd edition)* (pp. 358-376).