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Contact details: The Editor, AJTE, pj.williams@waikato.ac.nz

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A Comparative Analysis of Patterns of Girls' Attitudes towards Design and Technology: Botswana and Swaziland.

Michael Gaotlhobogwe

Abstract

A convenient sample of 965 high school girls drawn from three different localities in Botswana and Swaziland was used to compare patterns of girls' attitudes towards Design and Technology between the two countries. Factor Analysis and independent samples t-test results revealed a somewhat different pattern. In Botswana, unlike in Swaziland the findings indicated significant differences between DT and NON DT girls in all factors that influenced their attitudes towards the subject. In terms of 'support' for example, it became apparent that in Botswana unlike in Swaziland DT girls had more support from their parents, siblings and teachers as opposed to NON DT girls. As a socialization problem rather than a biological determination problem, and as raising issues of moral justification and problems of moral obligation, any intervention to promote Design and Technology among girls should target not only them but their families as well.

Keywords: Botswana, Swaziland, Design and Technology, gender, attitudes, t-test.

Introduction

The Department of Industrial Design and Technology (IDT) in the Faculty of Engineering and Technology (FET) of the University of Botswana is in partnership with the Ministry of Education and Training in Swaziland to offer training for Design and Technology teachers from Swaziland. The numbers of teachers from Swaziland to Botswana for retraining in Design and Technology at the University of Botswana increased by 80 percent, from two in 2007 to ten in 2013 (the agreement is to send ten each year). This figure is an indication of the need for retraining of technology teachers in Swaziland in the area of Design and Technology, where, as in most countries in Southern Africa, it is relatively new. The history of Design and Technology education in both countries is similar: i.e. the subject has evolved from craft subjects such as Woodwork and Metalwork. As a result of this history, the subject is viewed as a motor skills development practical subject suitable for less academic male students.

This view of Design and Technology has had a major effect on the development of technology education the world over (Ardies, Maeyer & Gijbels, 2013; Dakers, 2006, 2007; Dingalo & Moalosi, 2003; Volk, Ming & Lo, 2003). Between 2007 and 2013, the 48 teachers at the University of Botswana from Swaziland for example, were all male, compared to the 71 teachers from Botswana 12 (17%) of whom were female. About 280 teachers from Swaziland are yet to be retrained in this subject area and only ten percent are female. This gender imbalance is a reflection of deep-rooted stereotypical attitudes and perceptions of the Swati towards science and technology education. Dlamini, Ngwenya & Dlamini (2004) noted that the Swati society and parents' attitudes towards girls being able to attempt science were believed to be facilitating or limiting girls' choice of science as a program of study. These stereotypical attitudes towards science and technology education, coupled with a male-dominated teaching force compromises quality in access and participation in technical, vocational and education training as espoused in the Technical and Vocational Education and Training and Skills Development (TVESD) policy (Mamba, 2010). With a male-dominated teaching force,

technology education in Swaziland is bound to have a double-edged effect of gender imbalance. On the one hand would be young girls who do not take up opportunities to pursue technology education, and on the other would be a male-dominated teaching force who create an image suggesting that technology education is a masculine field of study.

Literature Review

Although Design and Technology evolved from craft-based subjects (Moalosi, 2001), it is a relatively new school subject in most parts of the world (Owen–Jackson, 2002; Barlex 2007; Ginestié, 2005). The short history of Design and Technology in Southern Africa and its association with notions of craft have made it an unpopular subject in schools because neither teachers nor students are familiar with it. Gaotlhobogwe, Laugharne, and Durance (2011) noted that in Europe and the USA 20 years ago, as in Africa today, technology education was new in the curriculum and had evolved from craft-based subjects aimed at less academically oriented students and this appeared to be the main reason why students did not perceive the subject as an important one to choose. Becker and Maunasaiyat (2002) observed that through PATT studies around the world, it became evident that students had incomplete and vague concepts of technology. These incomplete and vague concepts would definitely affect the students' disposition towards any technology related subject such as Design and Technology.

Several studies (McCarthy & Moss, 1990; Volk & Ming, 1999; Meide, 1997; Van Rensburg, Ankiewicz & Myburgh, 1999) have discovered that girls had a stronger gender discrimination view related to themselves regarding technology. Growney (1995, p.23) made an observation that "statistical evidence indicates that although when girls choose to engage with Technology they do well, very few make that choice". This gender discrimination view of girls related to themselves and technology related subjects has been ascribed to several factors: traditional attitudes of teachers (Indoshi, Wagah, & Agak, 2010); negative attitudes of parents (Indoshi et al., 2010); lack of female teacher role models (Growney, 1995); conformity to family and societal norms of femininity and masculinity (Gaotlhobogwe, 2004); and absence of support from families (Lin, Wen-huiTang, & Feng-Yang (2012). Studies carried out in Kenya (Indoshi et al., 2010; Wagah, Indoshi, & Agak, 2009) on attitudes of students and teachers towards Art and Design which, like Design and Technology, is one of the subjects in the secondary school curriculum experiencing a steady decline in enrolment of students, yielded important findings that may benefit this present study. Indoshi et al. (2010) and Wagah et al. (2009) developed a conceptual framework (Figure 1) illustrating the complex nature by which the emotional (for instance liking or disliking) component, the cognitive (beliefs) component, and the behavioral (tendency to act towards a subject) component of attitudes are formed and changed.

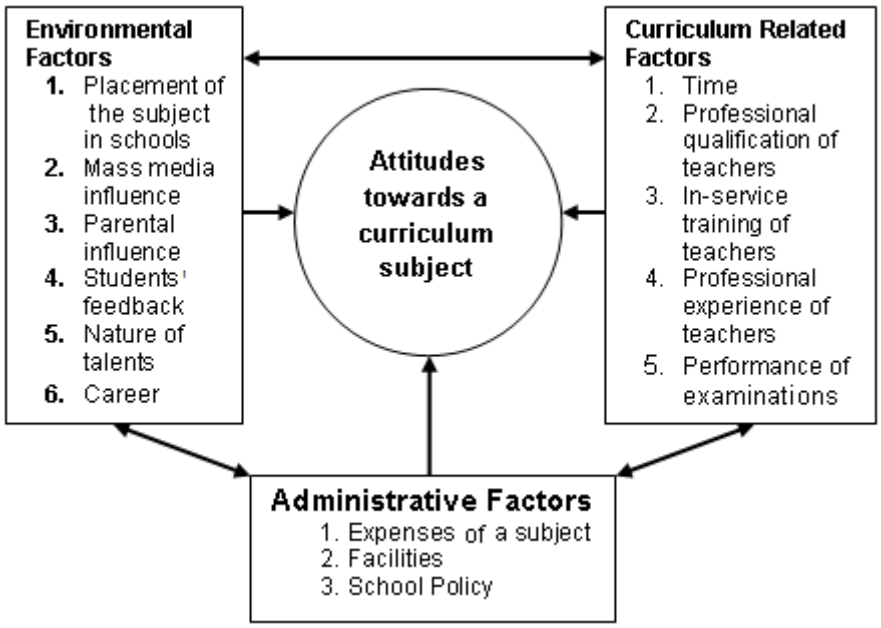

Figure 1. Attitudes formation and change framework
Source: Adopted from Indoshi et al. (2010) & Wagah et al. (2009).

The study reported here focused on the cognitive and behavioral components of attitudes to Design and Technology since it was anticipated that most of the participating girls would be non-Design and Technology students who might not have had the chance to experience the subject to develop any emotions towards it. Also, non-Design and Technology girls' attitudes were less likely to be influenced by curriculum related and administrative factors.

In Botswana (Gaotlhobogwe, 2004) and in Swaziland (Examination Council of Swaziland, personal communication, 2011), as in many other countries in Southern Africa, there is overwhelming evidence that enrolment figures in Design and Technology are declining. The situation in Botswana is worse for girls who choose to deviate from the technological line of career as they proceed with their education (Gaotlhobogwe, 2004).

The Examinations Council of Swaziland (Personal Communication, 2011) recorded a total candidature for Swaziland General Certificate of Secondary Education (SGCSE) Design and Technology of 200 girls in 2007, 120 girls in 2008, 80 girls in 2009, 50 girls in 2010 and 25 girls in 2011 as indicated in Figure 2. In 2011, the country had only three female teachers out of about 280 teachers of Design Technology (Personal Communication, 2011). Figure 2 also shows declining Design and Technology female candidature for Botswana Junior Certificate Examinations (BJCE) between 1999 and 2007.

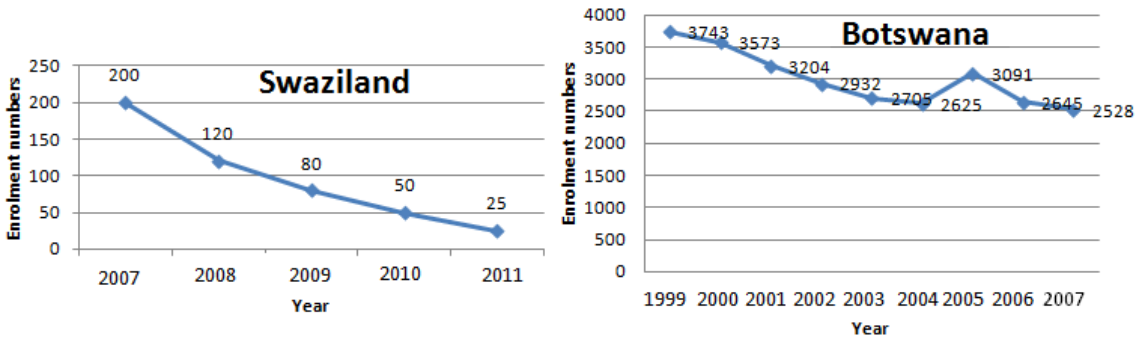

Figure 2: Declining Design and Technology female candidature for SGCSE and BJCE

Source: Personal communication with Examination Council of Swaziland, 2011 and Botswana Examinations Council, 2008).

Students have certain reasons why they behave in a particular manner towards school subjects. In other words, factors, some of which are shown in Figure 2 must have influenced their decisions to behave in that particular way towards the subject, and identifying these factors would be the first step before being able to address negative attitudes towards a curriculum subject. Adeyemi (2009) discusses literature that reveals various reasons why students prefer to choose some subjects relative to others. According to Adeyemi, one study in England identified enjoyment and interest; usefulness for future; and previous performance as factors that influenced students' preference to choose some subjects over others. The study further found that by contrast, the myths that students choose subjects because they are 'easy' or because of the pressure from friends, teachers, parents or from other sources seemed not to be influential (Adeyemi, 2009, p.102). However, according to related studies (Volk & Ming, 1999; Indoshi et al., 2010; Wagah et al., 2009), what Adeyemi referred to as myths is, reality in technology related education, possibly because of the nature of the history of technology education. Gaotlhobogwe (2004, p. 21) also indicated that "girls and boys have always settled for choices that conform to family and social norms of femininity and masculinity". As discussed earlier in this section, because Design and Technology is a relatively new subject, students, particularly girls, may succumb to pressure from friends, teachers, and parents or from other sources when choosing the subject. Volk and Ming (1999, p.57) observed that "the attitudes students have about technology, whether received through parents, peers, schooling, or one's daily life experience, play an important role in their ability to participate actively in their current and future technological world". More than just personal choice, the aggregate uptake of curriculum subjects can also have large effects on national economies and social development (Gaotlhobogwe et al., 2011).

Purpose of the Study

The purpose of this study was to investigate and compare patterns of factors influencing girls' attitudes towards Design and Technology in Botswana and Swaziland high schools; to examine how these factors could be explored to address the problem of gender imbalance in Design and Technology in Swaziland; and to make recommendations to address the compromised quality in access and participation in TVESD. In order to meet this purpose, the following research questions guided the study:

- What factors influence girls' attitudes towards Design and Technology in Swaziland?
- What factors influence girls' attitudes towards Design and Technology in Botswana?
- Are there significant differences in factors that influence girls' attitudes towards Design and Technology between Botswana and Swaziland?
- Are there significant differences in attitudes towards the subject between Design and Technology and non-Design and Technology girls in Botswana and Swaziland?

Significance of the Study

While it is a worthwhile investment for the governments of Swaziland and Botswana to train teachers in the area of Design and Technology, there are implications, particularly in regard to finance. Lauglo (2004) warned that the costs of vocational subjects or technology education usually are distinctively "high," and so it is important to assess the cost implications of decisions to invest in such, particularly when such investment compromises quality in access and participation due to gender orientation. The results of this study provide the Ministries of Education in Swaziland and Botswana with a practical evidence-based option for relevant, tailor–made interventions focused towards females to meet their specific technological education needs. The study provides a basis for comparison of patterns of students' attitudes

towards Design and Technology between the countries of Botswana and Swaziland. Such a comparison provides opportunities for information sharing and future research collaborations between technology educators in Botswana and Swaziland.

Methodology

Measures

A quantitative research approach was adopted in this study. A questionnaire adopted from Gaotlhobogwe (2010) and influenced by the PATT (Bame & Dugger, 1989) studies around the world and the Attitudinal Technology Profile (ATP) (Ankiewicz & Van Rensburg, 2001) study in South Africa was used. This questionnaire was developed for purposes of appraising pupils attitudes towards Design and Technology. The Cranach's alpha coefficient for the fifteen items was .665 suggesting that the items had relatively acceptable internal consistency (note that a reliability coefficient of ⩾.5 is considered "acceptable" for preliminary research (Robinson, Shaver, & Wrightsman, 1991; Peterson, 1994)

Participants

The target population for this study was girls drawn from high schools offering Design and Technology. Three of these high schools were selected from Botswana and three from Swaziland. Stratified sampling was used to select three schools from three distinct locations (e.g. rural, semi-urban, and urban) from each country. In Swaziland, schools from the following localities were selected for the study; a city; a rural area about 40 km from a city); and a semi-rural village about 15 km from the capital city. In Botswana, schools from the following localities were selected for the study: a city; a rural village about 250 KM a city; a semi-urban village 700 km from a city). A convenient sample of 965 girls from the six schools completed the questionnaire. See Table 1 for the distribution of the numbers of Design and Technology and non-Design and Technology girls who completed the questionnaires in Botswana and Swaziland.

Table 1: Distribution of the numbers of Design and Technology (DT) and non-Design and Technology (NON DT)

Country	DT	NON DT
Botswana	82	407
Swaziland	78	398

Data collection procedure

Permission to conduct the study was granted by the Ministry of Education and Training in Swaziland and by the Ministry of Education and Skills Development in Botswana. Ethical procedures and considerations were defined and adhered to: to ensure that participants were protected and were provided with information relating to the nature and purpose of the research; and to understand and to participate without coercion. Participants and their parents or guardians signed information and consent forms before they could participate in the study. As an ethical measure to ensure confidentiality and anonymity, the names of participants and participating schools in this study are not given. Data collection was carried out over three weeks in the summer of 2012. Due to cost implications, data collection in Swaziland was done by three Research Assistants (RAs) who were technology teachers retraining in Design and Technology at the University of Botswana at the time. Prior to data collection, these RAs were trained on how they were expected to conduct the administration of the questionnaires in their home country. During data collection, a briefing session with potential participants was conducted by

the researcher (RAs in the case of Swaziland) with the help of resident teachers after which potential participants were given their consent forms and those of their parents to complete and return to school the following day. The questionnaires were administered by the resident teachers in the presence of the researcher (RAs in the case of Swaziland) to only those who completed and returned their consent forms.

Data analysis:

Identifying factors that influence girls' attitudes towards Design and Technology in Swaziland and Botswana

In order to identify factors that influence girls' attitudes towards Design and Technology in Swaziland and Botswana, Exploratory Factor Analysis (EFA) was used to reduce the number of items for ease of analysis and interpretation (Field, 2005; Thomson, 2005). Data were factor-analyzed with Principal Component Analysis (PCA) to reduce the complex data set to a lower dimension that is easy to interpret from hidden data structures (Shlens, 2005*)*. By performing the PCA, data from the questionnaires was arranged and parameterized along the principal factors that describe attitudes of girls towards Design and Technology. In the PCA, objects or variables that are similar to each other have similar scores on each factor (or axis), while dissimilar ones are far apart (Gaotlhobogwe et al., 2011). This visual understanding from the PCA provided inference on the patterns of attitudes of girls towards Design and Technology in Botswana and Swaziland. Varimax orthogonal rotation was used on attitude to Design and Technology questionnaires because most of the factors in this scale were not correlated (Thomson, 2005).

Establishing whether there are significant differences between Botswana and Swaziland in factors that influence girls' attitudes towards Design and Technology

Independent Samples t-test was used to establish whether there were significant differences between Botswana and Swaziland in factors that influence girls' attitudes towards Design and Technology. Following Field, (2005), Independent Samples t-test was used to test difference between two unrelated groups across the same continuous, dependent variables. Independent Samples t-test procedures were used to investigate differences across students' characteristics of country of origin (Botswana or Swaziland) to ascertain the level of differences in factors that influenced their attitudes towards Design and Technology. Before conducting the analysis, assumptions were assessed to ensure that the data set was suitable for Independent Samples t-test.

Establishing whether there are significant differences in attitudes towards the subject between Design and Technology and non-Design and Technology girls in Botswana and Swaziland

Independent Samples t-tests were also used to establish whether there were significant differences in factors that influenced girls' attitudes towards Design and Technology between DT and NON DT girls in Botswana and Swaziland.

Results

A total of 965 (Botswana = 489; Swaziland = 476) questionnaires were analyzed using SPSS Version 21. In order to understand the main patterns of attitudes to Design and Technology, Principal Component Analysis was performed on the data. This commonly used analysis allowed the extraction of the main patterns that describe attitudes to Design and Technology from high density information. A Varimax orthogonal rotation method, commonly used when factors are correlated (Field, 2005; Thomson, 2005), was used. Based on scree plots and Kaiser' Little Jiffy (eigenvalues >1), the 15 items that asked about the attitudes of girls towards Design and Technology in Swaziland subscale converged into five factors that accounted for

52.70 percent of variation in item responses after extraction (see Appendix A). The 15 items that asked about the attitudes of girls towards Design and Technology in Botswana converged into four factors that accounted for 47.93 percent of variation in item responses after extraction (see Appendix B). Factor loading values greater than 0.40 showed that an item loaded on a particular factor. The five factors that influenced girls' attitudes towards Design and Technology in Swaziland are Importance, Difficulty, Support, Knowledge, and Pass Rate (see Appendix A). The four factors that influence girls' attitudes towards Design and Technology in Botswana are Complexity, Importance, Gender and Support (see Appendix B).

In order to establish whether there were significant differences in factors that influence girls' attitudes towards Design and Technology between Botswana and Swaziland, the Independent Samples t-test was performed to test differences between the two countries across the two common factors (Importance and Support) simultaneously. The results of the test indicated no significant difference in terms of Support (t (853) = 2.220, p=0 .027), and significant difference in terms of Importance (t (853) =-7.564, p= .000) (see Appendix C).

To establish whether there were significant differences in girls' attitudes towards Design and Technology between DT and NON DT girls in Botswana and Swaziland, the Independent Samples t-test was also performed to test differences between the two groups (DT and NON DT girls) across the two common factors (Importance and Support) simultaneously. The results of the test indicated significant differences across the two common factors between DT and NON DT girls in Botswana and Swaziland: in terms of Importance [t(853) = -8.135, p = .000] and in terms of Support [t(853)= -7.222, p = 0.000]. (see Appendix D).

The results of the test indicated that in Swaziland there was a significant difference between DT and NON DT girls in terms of Importance (p = .000), Difficulty (p=.000) and Knowledge (p=.000). However, there was no significant difference between DT and NON DT girls in terms of Support (p □ 0.05) and Pass Rate (p □ 0.05). (see Appendix E)

The results of the test indicated that in Botswana there was a significant difference between DT and NON DT girls in terms of complexity t (p=.000), Importance (p = .000), and Support (p □ 0.05). However, there was no significant difference between DT and NON DT girls in terms of Gender (p □0.05). (see Appendix E).

Discussion

Patterns of girls' attitudes towards Design and Technology in Botswana and Swaziland are somewhat similar, indicating that the two countries could collaborate in efforts to promote participation of girls in this subject. Two factors (Support and Importance) emerged as common in influencing girls' attitudes towards Design and Technology in Botswana and Swaziland. These results indicate that the amount of support provided, or not provided, by parents, siblings and teachers influence these girls' attitude towards the subject in both countries. So the limited numbers of girls enrolling in Design and Technology in both countries is a sign that these girls do not get much support or encouragement to do so from all whose support matters. Potentially, the enrolment of girls in Design and Technology could be bolstered by promoting the subject to the public and by ensuring that girls get much social support to alleviate potential obstacles. Lin et al. (2012) discuss a study in which women felt helpless and oppressed within their families in terms of using Information and Communications Technology. The authors report that the absence of support and help from families, and the constraints these women experienced in using their home computers, hindered their ICT learning (Lin et al. p. 80); and although they recognized its importance in the modem world and were willing to learn, the lack of support from family members left them feeling anxious and helpless (Lin et al. p. 81).

The number of girls enrolled in the subject in both countries is also an indication of the perceived importance of the subject to these girls. The more females take up technology related jobs and increase female role models, the more the subject will be perceived as important, and

then the attitudes will be influenced positively by environmental factors, as depicted in the attitude formation framework.

Differences between the two countries in patterns of girls' attitudes towards the subject emerged in five different areas. Factors that emerged as having an influence on girls' attitude towards the subject in Swaziland and not having the same influence on girls' attitude in Botswana were:

1. The perceived level of difficulty of the subject;
2. Lack of knowledge about the subject; and
3. The low pass rate of the subject.

All of the factors above have a direct bearing on the role of the teacher of Design and Technology. It is the teachers' responsibility to dispel such perceptions as harbored by most girls that Design and Technology is a difficult subject. There have been studies (Growney, 1995; Gaotlhobogwe, 2004) that have proved that girls who enroll in Design and Technology perform as well or better than boys. Girls have always perceived Design and Technology to be a difficult subject area for them. The fact that girls in Swaziland view lack of knowledge about the subject as an influencing factor is a call upon the teachers and all who are involved to promote the subject to girls. Low pass rates, coupled with the perceived level of difficulty of the subject, are a major drawback in attracting girls into Design and Technology. Pass rates and level of difficulty of a subject are attributable to the methods of delivery and assessment which, according to the attitudes formation and change framework fall under curriculum related factors. It is important that these two processes are reviewed to align them with the needs of the learners. Gaotlhobogwe (2004) observed that even though there were differences in boys' and girls' projects in Botswana secondary schools, the difference was in the context from which projects were conceived and not in craftsmanship. However, the same study indicated that Design and Technology was a more right-brain dominated subject and therefore favorable to boys. This is a conclusion based on the right brain vs left brain theory as well as personal experience. However, it must be noted that recent research has shown that the brain is not nearly as dichotomous as once thought. So according to the right brain vs left brain theory, for it to appeal to left-brain dominated learners, most of whom are females, (Dennison et al., 2013) the curriculum, its instruction and assessment procedures need to be developed to accommodate left-brain dominant talents and skills.

Factors that emerged as having an influence on girls' attitude towards the subject in Botswana and not having same influence in girls' attitude on Swaziland were:

1. The perceived level of complexity of the subject; and
2. The gendered nature of the subject.

The perceived level of complexity of Design and Technology is a common factor among girls; it encompasses such perceptions as feeling inadequate to perform well in a subject area that is masculine in nature. Historically, girls felt threatened by the outlook of the subject and perceive it as not suitable for them. Botswana has made tremendous strides in reshaping the outlook of Design and Technology, for example, building multi-purpose laboratories or workshops without machinery that could otherwise be intimidating to girls. However, the results of this study show that the legendary impression made in the past will take a long time to disappear. The underrepresentation of females in teacher training for Design and Technology in Swaziland is a way of exacerbating rather than counteracting that impression. Although in Swaziland this factor did not emerge as an influential one, most of the items loading high in this factor are the same items loading higher in the Difficulty factor.

The gendered nature of Design and Technology emerged as a factor in Botswana where the subject is more established and familiar to girls, than in Swaziland where girls lack knowledge on the subject. The lack of knowledge on the subject in Swaziland is coupled with lack of female role models, or significant others, from which these girls could find solace. A similar

observation was made by Dlamini et al. (2004) when they wrote that exposure to science fields through family members and significant others in science careers boosts girls' choice of science for a course. However, according to Gaotlhobogwe (2004) and Gaie and Nleya (2007) even in Botswana where there is increased access to the subject by girls, their perceptions about it being masculine have not changed. As a result, Gaie and Nleya (2007) observed that technology related subjects in Botswana are fraught with gross gender inequalities.

Comparison of DT and NON DT girls in both countries

The findings revealed a significant difference between DT girls and NON DT girls when it comes to the perceived level of complexity of the subject. It seems that girls perceive Design and Technology as a complex subject because of ignorance, but once they enroll into it their perception changes. Significant differences also emerged between DT girls and NON DT girls in Botswana and Swaziland when it comes to perceived importance of the subject. It seems that those who enrolled in the subject have begun to appreciate the importance of the subject more than those not enrolled.

The results indicated no significant difference between these two groups of girls both in Botswana and in Swaziland when it comes to support. This means that both DT girls and NON DT girls alike do not have sufficient support from parents, siblings and teachers. Both DT girls and NON DT girls need to be supported to develop their interest and to allay their fears of the subject

Comparison of DT and NON DT girls in Swaziland

A comparison of DT and NON DT girls in Swaziland alone indicated a significant difference in terms of their perception of the importance; the level of difficulty; and knowledge of the subject. This is an indication that once girls enroll in Design and Technology their perceptions regarding the importance; the level of difficulty; and their general knowledge of the subject changes. However, the results indicated no significant difference between DT and NON DT girls in terms of support, which is an indication that in Swaziland both DT and NON DT girls do not get support from their parents, siblings and teachers. The results also indicated no significant difference between DT and NON DT girls in terms of the low pass rate of the subject. This is an indication that the low pass rate of the subject influence upon the attitudes of both DT and NON DT girls. For DT girls, the low pass rate is a threat and a demotivating factor and for NON D&T girls it is a wall that drives them further away from the subject to a point where they would even discourage their siblings from enrolling in the subject.

Comparison of DT and NON DT girls in Botswana

A comparison of DT and NON DT girls in Botswana alone indicated a significant difference in terms of their perception of the support; the level of complexity; and importance of the subject. This is an indication that once girls enroll in Design and Technology, their perception regarding the importance and the level of complexity changes. However, unlike in Swaziland, the results show some evidence that in Botswana DT girls get more support from their parents, siblings and teachers than NON DT girls. The difference between Swaziland and Botswana may be a result of Botswana now having a sizable number of female teachers and officers in the subject and therefore these female teachers and officers act as role models, and also convince the society at large that females can venture in technological fields.

Studies in this area have shown that there is a complex interaction of underlying factors that influence patterns of attitudes towards technology education. The scope of this study would not allow all the factors involved to be explored. The study focused on the cognitive and behavioral factors which were more likely to influence NON DT girls than emotional factors.

Conclusions

This comparative study has revealed some of the underlying patterns of girls' attitudes towards Design and Technology in Botswana and Swaziland. While the history of the subject in both countries is similar, the study has shown that patterns of attitudes of girls from these countries are different.

In Swaziland, for example, the findings indicated a significant difference between DT and NON DT girls in factors (except Support and Pass Rate) that influence their attitudes towards the subject. This is an indication that as girls enroll in Design and Technology, their perceptions and attitudes change. Unfortunately, in Swaziland the results indicated that there is no significant difference between DT and NON DT girls when it comes to support. This lack of support, coupled with low pass rate, also indicated no significant difference between these two groups of girls, should be a concern to the Design and Technology community in Swaziland, because it is bound to be a big obstacle in efforts to promote the subject among girls. In Botswana, unlike Swaziland, the findings indicated significant differences between DT and NON DT girls in all factors that influence their attitudes towards the subject, including support. This is an indication that in Botswana, unlike in Swaziland, DT girls get more support from their parents, siblings and teachers in contrast to NON DT girls. A study conducted in Botswana (Gaotlhobogwe, 2004) reported that in Design and Technology girls enjoyed more teacher support than boys.

The gendered nature of Design and Technology has been viewed as a socialization problem rather than a biological determination problem (Gaotlhobogwe, 2004). The same has been viewed as raising issues of moral justification and problems of moral obligation (Gaie & Nleya, 2007) and so any intervention to promote the subject among girls should target not only them but their families as well.

Affiliation

Michael Gaotlhobogwe,
Leader, Department of Education Foundations
University of Botswana
Botswana
gaotlhobogwe@mopipi.ub.bw

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Appendix A

Factor Loadings for Swaziland

	Importance	Difficulty	Support	Knowledge	Pass rate
DT not important for my future career	.743				
DT not important in my life	.712				
No interest in DT	.625				
Few jobs related to DT	.506				
DT is a difficult		.763			
Likely to fail DT		.749			
Lack confidence in DT		.585			
DT not suitable for girls		.444			
Lack parental support for DT			.738		
Lack siblings support for DT			.716		
Lack teachers' support for DT			.505		
Only a few girls do DT					
Lack female role models in DT				.718	
Lack of knowledge about DT				.631	
DT pass rate is low					.888

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

b. Only cases for which School Ref = Swa are used in the analysis phase.

Appendix B

Factor Loadings for Botswana

	Complexity	Importance	Gendered	Support
Likely to fail DT	.763			
DT is a difficult	.717			
DT not suitable for girls	.551			
No interest in DT	.544			
Lack of knowledge about DT	.507			
DT not important for my future career		.783		
DT not important in my life		.733		
Only a few girls do DT			.747	
Lack female role models in DT			.561	
DT pass rate is low			.555	
Few jobs related to DT			.426	
Lack siblings support for DT				.736
Lack teachers' support for DT				.656
Lack parental support for DT				.611
Lack confidence in DT				

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

b. Only cases for which School Ref = Bots are used in the analysis phase.

Appendix C

Independent Samples Test for Common factors between Botswana and Swaziland girls

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Importance	Equal variances assumed	5.101	.024	-7.564	853	.000	-.491	.065	-.619	-.364
	Equal variances not assumed			-7.540	830.413	.000	-.491	.065	-.619	-.363
Support	Equal variances assumed	.170	.680	2.220	853	.027	.150	.068	.017	.282
	Equal variances not assumed			2.218	846.976	.027	.150	.068	.017	.283

Appendix D

Independent Samples Test for Common factors between DT and NON DT girls

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Importance	Equal variances assumed	.207	.650	-8.135	853	.000	-.716	.088	-.889	-.543
	Equal variances not assumed			-7.993	188.581	.000	-.716	.090	-.893	-.539
Support	Equal variances assumed	13.844	.000	-7.222	853	.000	-.647	.090	-.823	-.471
	Equal variances not assumed			-8.482	228.427	.000	-.647	.076	-.797	-.497

Appendix E

Group Statistics and Independent Samples Test for Swaziland

Group Statistics

	DT or NDT	N	Mean	Std. Deviation	Std. Error Mean
Importance	DT	72	.6064672	.82472917	.09719526
	NDT	368	-.1186566	.98910186	.05156050
Difficulty	DT	72	.5153639	.72076341	.08494278
	NDT	368	-.1008321	1.01655347	.05299151
Support	DT	72	-.0012530	.70485079	.08306746
	NDT	368	.0002452	1.04884265	.05467470
Knowledge	DT	72	.6310212	.70003193	.08249955
	NDT	368	-.1234607	1.00398125	.05233614
Pass rate	DT	72	.0173614	.57710848	.06801289
	NDT	368	-.0033968	1.06380532	.05545469

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Importance	Equal variances assumed	4.696	.031	5.835	438	.000	.72512381	.12427279	.48087870	.96936892
	Equal variances not assumed			6.591	114.824	.000	.72512381	.11002456	.50718278	.94306484
Difficulty	Equal variances assumed	14.968	.000	4.906	438	.000	.61619599	.12560774	.36932718	.86306480
	Equal variances not assumed			6.155	133.118	.000	.61619599	.10011682	.41817042	.81422156
Support	Equal variances assumed	4.180	.041	-.012	438	.991	-.00149818	.12901236	-.25505841	.25206205
	Equal variances not assumed			-.015	140.733	.988	-.00149818	.09944610	-.19809953	.19510317
Knowledge	Equal variances assumed	6.560	.011	6.091	438	.000	.75448184	.12387313	.51102222	.99794146
	Equal variances not assumed			7.722	135.403	.000	.75448184	.09769979	.56126693	.94769675
Pass rate	Equal variances assumed	4.550	.033	.161	438	.872	.02075823	.12900857	-.23279455	.27431100
	Equal variances not assumed			.237	181.282	.813	.02075823	.08775520	-.15239475	.19391121

Appendix F

Group Statistics and Independent Samples Test for Botswana

Group Statistics

	DT or NDT	N	Mean	Std. Deviation	Std. Error Mean
Complexity	DT	65	.4657522	1.10603314	.13718653
	NDT	350	-.0864968	.95603868	.05110242
Importance	DT	65	.4101066	.85525721	.10608160
	NDT	350	-.0761627	1.00745616	.05385080
Gender	DT	65	-.2344130	1.08236612	.13425099
	NDT	350	.0435338	.97942723	.05235259
Support	DT	65	-.2994023	.84047292	.10424784
	NDT	350	.0556033	1.01828824	.05442980

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Complexity	Equal variances assumed	1.959	.162	4.169	413	.000	.55224901	.13246690	.29185558	.81264245
	Equal variances not assumed			3.772	82.701	.000	.55224901	.14639536	.26105899	.84343904
Importance	Equal variances assumed	4.138	.043	3.654	413	.000	.48626929	.13309166	.22464774	.74789083
	Equal variances not assumed			4.087	100.017	.000	.48626929	.11896728	.25024208	.72229650
Gender	Equal variances assumed	1.241	.266	-2.066	413	.039	-.27794681	.13453204	-.54239975	-.01349387
	Equal variances not assumed			-1.929	84.586	.057	-.27794681	.14409762	-.56447171	.00857810
Support	Equal variances assumed	1.491	.223	-2.647	413	.008	-.35500562	.13409240	-.61859434	-.09141689
	Equal variances not assumed			-3.019	102.257	.003	-.35500562	.11760193	-.58826146	-.12174977