ISSN 2056-5852

ASSESSMENT OF CONVERGENT THINKING AMONG SECONDARY SCHOOL STUDENTS IN TANZANIA

Joel Matiku Joshua
College of Education
Mwalimu Julius K. Nyerere University of Agriculture and Technology
P.O. Box 976 Musoma, **TANZANIA**

ABSTRACT

The purpose of this study was to assess convergent thinking among secondary school students in Tanzania. A total number of 444 students of whom 217 were males and 227 were females from twelve secondary schools in Tanzania were exposed to the adopted insight tasks (Dow and Mayer (2004). Assessment was made around three variables which are school ownership, geographical location and sex. It was found that students from urban schools scored higher than students from rural schools regardless of sex and school ownership in all components of convergent thinking. It was further found that while there was no significant difference between male and female students in the performance of mathematical insight tasks, male scored significantly higher than female students in spatial insight tasks. Discussion is made in terms of both creativity research and practical implications in the context of school learning.

Keywords: Spatial insight tasks, creativity research in Tanzania, Mathematical insight tasks, Verbal insight tasks, Convergent thinking research in Tanzania.

INTRODUCTION

Convergent thinking refers to the ability to come up with a single but correct solution to a given potential or actual problem (Santrock, 2004). In this article the term refers to one's ability to produce correct solution to the mathematical insight tasks, verbal insight tasks, and spatial insight tasks. These three kinds of tasks are meant to measure potential creative ability in a given task to enable the subject to reach the correct solution to a novel problem. Assessment of convergent thinking was based on three major variables reflected in three research questions. First, what is the difference in convergent thinking by school ownership? Second, what is the difference in convergent thinking by geographical location of the school? And third, what is the difference in convergent thinking by Sex? These questions have been thoroughly addressed in this article.

LITERATURE REVIEW

Measures of Convergent Thinking

Convergent thinking has been measured using several tests developed from different theories. For example, Gallagher (1965) used three Measures of Intellectual Abilities to measure convergent thinking. These were a test of Word Change, a test of Sequential Association, and a test of Word Grouping. In a test of Word Changes, subjects are required to move from one word to the other by progressively changing one letter in the word. In a sequential association test, subjects are required to arrange the words such that all words are associated with those contiguous to it. In word grouping test subjects must group words into a set number of groups so that all words are used. Some studies (Danili, & Reid, 2006; Anwar *et al.*, 2012) have considered convergent thinking as the opposite of divergent thinking so that in measuring divergent thinking by requiring participants to mention as many uses of objects as possible,

ISSN 2056-5852

the scores of divergent thinking are arranged in descending order, so that those achieving low (preferably below the median) in the components of divergent thinking are labeled as being convergent thinkers while those scoring high above median are labeled divergent thinkers. These studies have been using the Gilford's Alternate Uses Task (AUT, 1967) and the Torrance Tests of Creative Thinking to measure creative potential on fluency, flexibility, elaboration and originality. Dow & Mayer (2004) also developed the Insight Problems tasks, a test categorizing convergent thinking into three factor groups of tasks measuring mathematical insights, verbal insights, and spatial insights. In the test, there are about 65 tasks measuring mathematical insights, 40 tasks measuring verbal insights, and 16 tasks for spatial insights. These insight problem solving tasks have been used to measure convergent thinking which reflects potential creativity.

Variations in Convergent Thinking

While there are a lot of empirical findings indicating the role of convergent thinking in education and psychology, there are a lot of debates as to whether variation in performance in different components of convergent thinking exists by such variables as school ownership, geographical location and sex. Variations in convergent thinking might be seen in the type of school ownership depending on cognitive skills the school put much emphasis in fostering among. Gallagher (1965) assumed that laboratory schools fostered divergent thinking while public schools fostered much of convergent thinking; and thus, compared the laboratory and public school girls on measures of convergent thinking and found that gifted girls in the public junior high schools were superior in convergent thinking than their counterparts in the laboratory schools. On the other hand, no differences were noted on the Convergent Thinking tests at the senior high school level, although the Word Grouping test showed a trend in favor of the public school girls over the laboratory school girls.

Joshua (2014) found that in Tanzania, the relationship between convergent thinking and past academic success was intervened by the type of school ownership such as government, private, or community school. This suggests that variation in convergent thinking might be determined by school ownership. An assumption behind this variation might lie in the variation in the services provided in these schools and the kind of thinking fostered in these schools.

Convergent thinking might also vary with sex. Benbow and Stanley (1983) found that a large sex difference in mathematical reasoning ability exists by age 13 and that boys perform higher than girls. They further concluded that boys dominate the highest ranges of mathematical reasoning ability before they enter adolescence, though the reasons for such differences are unclear. If sex differences remain consistent and universal then it might imply that a journey to gender equality as insisted in the contemporary policies of the world might need reconsideration. In a follow-up study 20 years later, Benbow *et al* (2000) found that such sex differences predicted differential educational and occupational outcomes among 1,975 mathematically gifted adolescents whose assessments at age 12 to 14 revealed robust gender differences in mathematical reasoning ability. For instance, specific areas of difference pointed out in the study are difference in inorganic versus organic disciplines and a career-focused versus more-balanced life; implying that males are likely to remain dominant in some disciplines, whereas females dominating in others.

Alan (1988) found that girls scored higher than boys on scales of grammar, spelling, and perceptual speed; while on the other hand, boys had higher means on measures of spatial visualization, high school mathematics, and mechanical aptitude; and no average gender differences were found on tests of verbal reasoning, arithmetic, and figural reasoning. Similarly, Hyde and Linn (1988) found a slight female superiority in verbal reasoning performance such that they concluded that sex differences in verbal ability no longer exist. Hyde and Linn also found no striking changes in the magnitude of sex differences at different ages thus, concluded that sex differences in verbal ability emerge around age 11 yrs.

However, other studies suggest that sex difference in cognitive thinking and in the fields related to science and mathematics might be the result of gender stereotypes. For example, Carli *et al* (2016) found that both male and female participants viewed men as scientists far than they viewed women to be scientists. They thus, suggest that gender stereotype might be a force behind sex differences found in the studies. And the stereotypes seem to be rooted in the hearts of both males and females in the societies because only women attending a single-sex college saw some similarity between the characteristics of women and scientists while both men and women attending a coeducational institution did not differ in their perception of the similarity between scientists and women. In similar way of thinking, Bilalic, Smallbone, McLeod and Gobet (2008) found that the performance the 100 best German male chess players was better than that of the 100 best German women. However, they argue that explanation for such variation should not be attributed to biological or intellectual ability differences but rather to statistical sampling.

Development of Convergent Thinking

The representational theory of the mind holds that mental states are attitudinal representations of the world, rather than attitudes to direct copies of reality (Dennett, 1978; Wimmer & Perrier, 1983). With this approach in mind, convergent thinking arises from the understanding of false beliefs when children reach around four years of age, the age at which children have developed representational and executive skills underlying their ability to handle false belief tasks (Suddendorf, 1999). As children grow, they come across challenges that require novel solutions. Inexperienced as they are, children receive guidance from their experienced parents, or guardians who lead them to realize the association between the known and the unknown challenges while putting emphasis to the relation between different aspects of reality from both known and unknown. This helps children to structure their semantic networks flexibly, providing the basis for the generation of novel problem solutions.

The Vygotsky's (1978, 1986) theory of cognitive development puts forward three major arguments. First, the understanding of children's convergent thinking is subject to the developmental analysis and interpretations of the same. Second, children's convergent thinking is mediated by words, language, and forms of discourse, which serves as psychological tools for facilitating and transforming mental activity. Third, convergent thinking originate in social relations and are embedded in a socio-cultural background. For Vygotsky, developmental analysis and interpretations of convergent thinking should not be viewed accurately in isolation but should be evaluated as a step in a gradual developmental process (Santrock, 2004).

Vygotsky believed that the development of convergent thinking involved learning to use the inventions of society such as language, mathematical systems, and memory strategies. Thus, to Vygotsky, since knowledge is distributed among people and environments, which include objects, artifacts, tools, books, and the communities in which people live, knowing can best be advanced through interaction with others in cooperative activities. Vygotsky's theory of cognitive development has explained the development of convergent thinking through its three major constructs such as transference, scaffolding, and the zone of proximal development. Vygotsky assumes that social interaction plays a major role in the origin and development of higher mental functions such as convergent thinking. To Vygotsky, convergent thinking would appear first on the interpsychological level and only later on the intrapsychological level.

METHODOLOGY

Subjects

This study was conducted among 580 form four secondary school students strategically selected from twelve secondary schools, six from one urban district and six from one rural district in Tanzania. Inclusion of a sample school was further based on the categories of a school such as traditional government, community, and non-government secondary schools. In the final analysis however, a total 444 sample was used, which is about 76.6 percent of the total administered test scripts. This is because in the screening process some scripts were found not complete in responses or not filled at all. The subjects in this study were heterogeneous in nature. About 48.9 percent (217) were males and 51.1 percent (227) were females. Their age varied between a low of 16 years and a high of 23 years with a mean age being 17.76 and a standard deviation of 1.19.

Measures

Convergent thinking was measured using the adopted Insight Problems tasks (Dow & Mayer, 2004). It is a test categorizing convergent thinking into three factor groups of tasks measuring mathematical insights, verbal insights, and spatial insights. In the test, there are about 65 tasks measuring mathematical insights, 40 tasks measuring verbal insights, and 16 tasks for spatial insights.

Examples of mathematical insight tasks are:

1. Smith Family: In the Smith family, there are 7 sisters and each sister has 1 brother. If you count Mr. Smith, how many males are there in the Smith family?

   Solution: *Two (the father and the brother)*

2. Water lilies: Water lilies double in area every 24 hours. At the beginning of summer there is one water lily on the lake. It takes 60 days for the lake to become completely covered with water lilies. On which day is the lake half covered?

   Solution: D*ay 59 then it doubles on the 60th*

Examples for verbal insight tasks are:

1. Hole: How can you cut a hole in a 3 x 5 card that is big enough for you to put your head through?

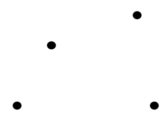
   Solution: *Cut a spiral out and unwind it*

2. Prisoner: A prisoner was attempting to escape from a tower. He found in his cell a rope, which was half long enough to permit him to reach the ground safely. He divided the rope in half and tied the two parts together and escaped. How could he have done this?

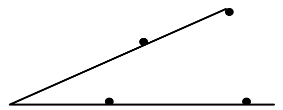
   Solution: *Unwind the rope and tie the ends together*

Examples for spatial insight tasks are:

1. **4 dots:** Without lifting your pencil from the paper, show how you could join all 4 dots with 2 straight lines



Solution:



2. Trees: A landscaper is given instructions to plant four special trees so that each one is exactly the same distance from each of the others. How is he able to do it?
Solution: *Plant them on a hill: three at the base one on the top like the four corner points on a pyramid*

However, only five items from each factor category were adopted and tested to the respondents in this study, making a total of 15 items in total. The test is normally scored by awarding one point for every correct response. Then the correct responses are totalized for each factor category, and then for the whole test so that the higher the score the higher the convergent thinking and the lower the score the lower the convergent thinking.

Validity and Reliability of the Test Materials

The test items were originally written in English. It was necessary to translate them into Kiswahili, because the respondents were more likely to express themselves better in Kiswahili than in English. This process required the maintenance of construct validity of the test items while addressing cross-cultural issues in sharing the meanings of the concepts. For example, during translation of the items, in the second question of the *Assessment of Convergent Thinking Test*, the term 'lilies', is not common in Kiswahili culture. The term 'magugumaji', which is a common plant in Tanzania, normally grows and covers large part of lakes and rivers, was selected. Though the term was not a direct translation, it maintained the original meaning since the emphasis was on a plant covering a water body and not the type of plant or specific species. In the same test, in question number 5 under mathematical insight tasks, direct translation for the term 'horse' was supposed to be '*farasi*' in Kiswahili. However, because the animal is not common and not known by most children in Tanzania, the term was replaced by the term *'ng'ombe'*, which means 'cow' in English. The animal (cow) was selected because cows are common and familiar animals reared and sold among people of Dodoma region, which was the area of study. The use of 'US$' in the same question was also replaced by the use of 'Tshs' (meaning Tanzanian shillings).

In question two in verbal insight tasks section of the same test, the use of 'inches' units was replaced by the use of centimeters and hence conversion of the measurements was made. This was done because students in secondary schools in Tanzania are learning measurements in metric system instead of empirical system, which was originally used in the instrument. The term 'triplicates' which is the answer for question three of the same section, is almost missing in Kiswahili, since most people use the phrase *'mapacha watatu'* for the term triplicate. Thus, during scoring of the instrument it was necessary to accept the phrase *'mapacha watatu'* literally meaning 'three twins' response instead of the ought to be answer which is *'triplicate'* as instructed in the original professional guide. In all these translations, the avoidance of direct or literal translation did not change the central focus of the items since the measured skills were maintained. *The Reliability* of the instrument was checked by calculating the Cronbach's alpha coefficients. The Cronbach alpha coefficients for Convergent thinking test items were: α = .92, for mathematical insight tasks, α = .93 for verbal insight tasks, and α = .90 for spatial insight tasks.

RESULTS

Performance in Convergent Thinking

It was found that performance in convergent thinking was higher in spatial insight tasks (M = 1.59, SD =.93), followed by mathematical insight tasks (M = 1.44, SD = .91) and verbal insight tasks (M=1.13, SD = 1.13). This means that on average, most students were much better in mathematical insight tasks than in other domains of insight problem solving.

The Difference in Convergent Thinking by School Ownership

To find out whether there was a difference in convergent thinking by school ownership, a one-way between-groups analysis of variance (ANOVA) was performed. School ownership had three levels namely; Government schools (N=165), Private schools (N=76) and Community schools (N=203). On the other hand, convergent thinking had three task categories namely; mathematical insight tasks, verbal insight tasks and spatial insight tasks.

Mathematical Insight Tasks and School Ownership

Results indicate that there was a statistically significant difference at the $p < .05$ level in mathematical insight tasks' scores for the three school categories: F (2, 444) = 8.8, p = .01. Despite reaching statistical significance, the actual difference in mean scores between the groups was quite small as reflected in the eta squared calculation, Eta Squared = .04. Post-hoc comparisons using the Tukey HSD test indicated that the mean score for government schools (M = 1.67, SD = .87) was significantly different from private schools (M = 1.32, SD = 1.04), which was also significantly different from community schools (M = 1.30, SD = .85). Figure 1 further illustrates the difference.

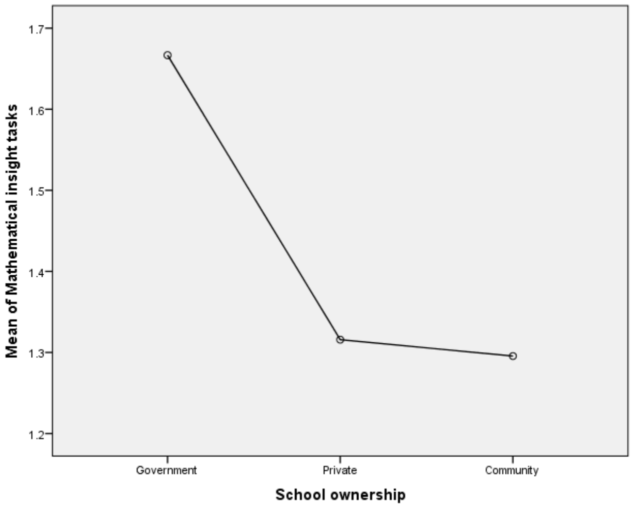


Figure 1: Difference in Mathematical Insight Tasks by School Ownership

Verbal Insight Tasks and School Ownership

It was found that there was a statistically significant difference at the $p < .05$ level in verbal insight tasks' scores for the three school categories: $F(2, 444) = 4.6$, $p = .01$. However, the mean difference between the groups was small, Eta Squared = .02. Post-hoc comparisons using the Tukey HSD test indicated that the mean score for government schools (M = 1.32, SD = 1.13) was significantly different from private schools (M = 1.08, SD = .98), which was also significantly different from community schools (M = 1.00, SD = .97). See the difference in an illustration in Figure 2.

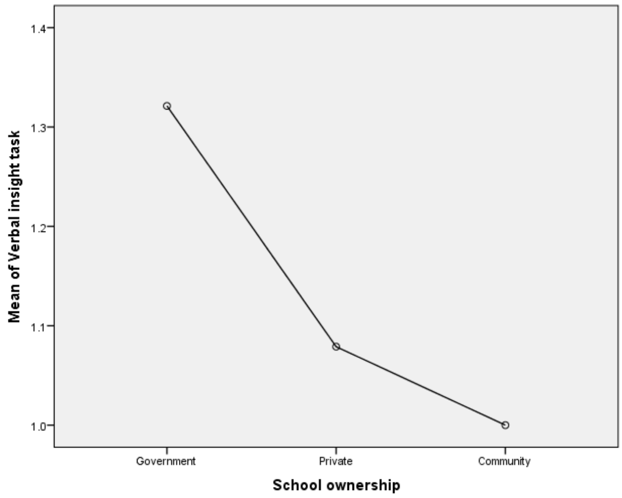


Figure 2: Difference in Verbal Insight Tasks by School Ownership

Spatial Insight Tasks and School Ownership

Results reveal the difference at the $p < .05$ level in students' scores in spatial insight tasks for the three school categories: $F(2, 444) = 15.16$, $p = .01$. The mean difference between the groups was moderate, Eta Squared = .06. Post-hoc comparisons using the Tukey HSD test indicated that the mean score for government schools (M = 1.87, SD = .95) was significantly different from private schools (M = 1.21, SD = .89), which was also significantly different from community schools (M = 1.52, SD = .93). The difference is further illustrated in Figure 3.

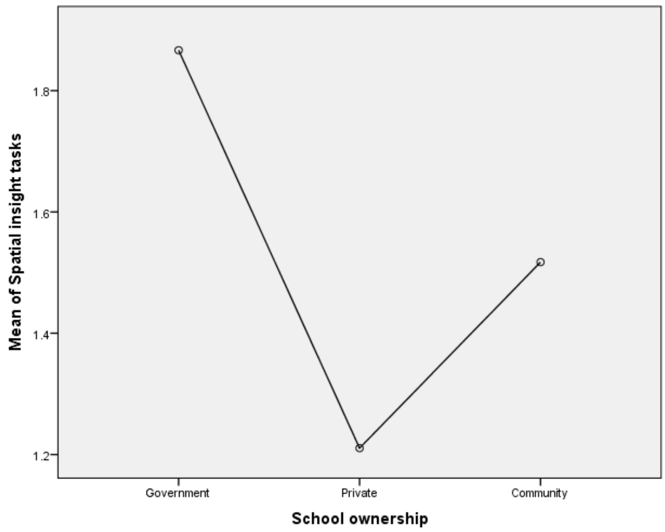


Figure 3: Difference in Spatial Insight Tasks by School Ownership

The Difference in Convergent Thinking by Geographical Location of the School

An independent samples t-test was performed to check for the difference in convergent thinking geographical location of the school. Geographical location of the school had two levels namely; urban (N=186) and Rural (N=256). Table 2 shows the results.

Table 1: Difference in Convergent Thinking by Geographical Location

Convergent thinking Task	**Geographical Location**	**Descriptives**			**t-test for Equality of Means**		
		N	*Mean*	*Std. Deviation*	*t*	*df*	*Sig. (2-tailed)*
Mathematical Insight Tasks	*Urban*	186	1.71	.901	5.568	442	.000
	Rural	258	1.24	.858			
Verbal Insight Tasks	*Urban*	186	1.49	1.015	6.401	442	.000
	Rural	258	.88	.982			
Spatial Insight Tasks	*Urban*	186	1.72	.863	2.329	442	.020
	Rural	258	1.51	.967			

Difference in Mathematical Insight Tasks by Geographical Location

Data in Table 1 reveal a significant difference, t [(442) = 5.568, P < .01] between subjects from urban schools (N = 186, Mean = 1.71) and subjects from rural schools (N = 258, Mean = 1.24) in mathematical insight tasks scores. This means that on average, subjects from urban schools scored higher in mathematical insight tasks than their counterparts from rural schools.

Difference in Verbal Insight Tasks by Geographical Location

There was a significant difference, t [(442) = 6.401, P < .01] between subjects from urban schools (N = 186, Mean = 1.49) and subjects from rural schools (N = 258, Mean = .88) in verbal insight tasks scores. This means that on average, subjects from urban schools scored higher in verbal insight tasks than subjects from rural schools.

Difference in Spatial Insight Tasks by Geographical Location

As indicated in Table 1, there was a significant difference, t [(442) = 2.329, P < .05] between subjects from urban schools (N = 186, Mean = 1.72) and subjects rural schools (N = 258, Mean = 1.51) in spatial insight tasks. This means that on average, students from urban schools scored much better in spatial insight tasks than their counterparts from rural schools.

The Difference in Convergent Thinking by Sex

To analyze sex difference in convergent thinking an independent t-test for equality of means was performed. Table 2 presents the results.

Table 2: Difference in Convergent Thinking by Sex

Convergent thinking Task		Descriptives			t-test for Equality of Means		
Mathematical Insight Tasks	**Sex**	*N*	*Mean*	*Std. Deviation*	*t*	*df*	*Sig. (2-tailed)*
	Male	217	1.40	.882	-.924	442	.356
	Female	227	1.48	.928			
Verbal Insight Tasks							
	Male	217	.97	1.032	-3.213	442	.001
	Female	227	1.29	1.027			
Spatial Insight Tasks							
	Male	217	1.69	.992	2.047	442	.041
	Female	227	1.51	.859			

Difference in Mathematical Insight Tasks by Sex

Results indicates there was no significant difference, t [(442) = -.924, $P > .05$] between male subjects (N = 217, Mean = 1.40) and female subjects (N = 227, Mean = 1.48) in mathematical insight tasks scores. This might mean that any difference observed as in Table 2 might be attributed to chance.

Difference in Verbal Insight Tasks by Sex

Data in Table 2 reveal a significant difference, t [(442) = -3.213, $P < .05$] between male subjects (N = 217, Mean = .97) and female subjects (N = 227, Mean = 1.29) in verbal insight tasks scores. This means that on average, female than male students scored higher in verbal insight tasks.

Difference in Spatial Insight Tasks by Sex

As indicated in Table 2, there was a significant difference, t [(442) = 2.047, $P < .05$] between male subjects (N = 217, Mean = 1.69) and female subjects (N = 227, Mean = 1.51) in spatial insight tasks scores. This means that on average, male students scored much better in spatial insight tasks than their counterpart female students.

DISCUSSION

It has been found that students performed better in mathematical problem-solving insight tasks than in other domains of problem solving tasks. However, in all categories of the convergent thinking, performance was below 50 percent indicating general low potential creative abilities among secondary school students. With regard to sex difference in convergent thinking, the difference was insignificant in mathematical insight tasks such that it is logical to say it was by chance. These findings are different from the findings by Benbow and Stanley (1983), Alan (1988), and Benbow et al., (2000). All these studies found consistently that large sex difference in mathematical reasoning ability exists and predicted dominance in some jobs related to mathematics. Perhaps the difference in the age of participants might account for these differences. While Benbow and Stanley (1983) studied a sample of ages between 12 and 14 years of age; and Alan (1988) concluded sex difference in mathematical reasoning at 11 years of age; this study was done among young adults whose ages ranged between16 years and 23 years with a mean age being 17.76. At this age it seems males' ability in mathematical reasoning start to decline while that of female students rise to equally compete males' mathematical reasoning ability.

Another sex difference observed was on spatial and verbal abilities where males scored significantly higher than females. Alan (1988) found that males had higher means on measures of spatial visualization than females, the findings that are quite similar to the findings of this study. Further comparison indicates that while Alan (1988) and Hyde and Linn (1988) found no difference between males and females in verbal reasoning, the results in the present study found that male students scored higher than female students in verbal reasoning. Again, age difference might be explaining difference in the findings. However, in the overall convergent thinking, no significant sex difference was observed.

Implications for School Learning

Students in secondary schools need a special training to boost their creative potential abilities. This is because creativity facilitates the improvement of the living standards and is the solution to the problems arising in the rapidly changing world (Runco, 2004). However, regarding training on how one can go about solving insight problems, Dow and Mayer (2004) found that it is possible to train the skills of insight problem solving in a given domain. Successful problem solving in mathematical insight tasks could not mean that one could also automatically transfer the skills in solving verbal insights tasks. It implies that generalization of creativity to other fields in which one has not trained in is a challenge. This, in practical terms, means that creativity should be learned in a specific content. Thus, for students in the classrooms to learn creatively, each subject teacher must be creative enough to come up with new ways of training creative learning in the specific subjects and in the specific topics of the same subject matter. Oettingen, Marquardt, and Gollwitzer (2012) have suggested that creative performance can be fostered by fantasizing about one's creative performance and juxtaposing these fantasies with reflections on impeding reality. This argument implies that students need to be given a positive feedback on their potential abilities on creativity and help them identify possible challenges toward creativity.

Creative Potential for Students Regardless of their Sex

These findings might have both practical and policy implications. As pointed out in the past studies (Benbow & Stanley, 1983; Alan, 1988; Benbow *et al.*, 2000), male dominance in the reasoning abilities related to science and mathematics might still be practical for some years in the society. However, policy makers and researchers must carefully study the reasons behind these sex differences because their consistency seems to be diminishing with time and development of technology. For example, where gender stereotypes are high as Carli *et al* (2016) suggest, policy makers need to come up with the policies encouraging women to participate in mathematics and science, and therefore increasing the number of females in the careers related to the same. An argument that variation should be attributed to statistical sampling (Bilalic, Smallbone, McLeod & Gobet, 2008) might encourage the tendency in some developing countries such as Tanzania to come up with a policy to favor women as in special seats for women in the parliament. This tendency needs to be cautiously practiced because despite its partial logic it can lead to the possibility of representation of numbers rather than abilities even in the tasks that require ability in performance.

The present study has found that on average, female than male students scored higher in verbal insight tasks and scored almost similar in mathematical insight tasks. It is possible that students may benefit equally in the school learning in which students are encouraged to equally engage in the tasks planned to improve creativity and then be given a positive feedback on their potential abilities on creativity (Oettingen, Marquardt, & Gollwitzer, 2012).

It is possible that in contesting for being a member of parliament for example, one needs to be creative to come up with what exactly the voters face as challenges and how one plans to lead voters in solving the challenges. This is actually possible for students who have been well trained in verbal insight tasks, the potential ability that female than male students have scored higher. It is therefore illogical to favor rather than training female students to be as good as male students in all aspects of potential creativity.

Potential for Creative Research in Tanzania

Oettingen, Marquardt, and Gollwitzer (2012) have argued that mental contrasting turns positive feedback on creative potential to successful performance. This research was limited to measuring potential creativity as translated by the insight problem solving tasks. This way of measuring creativity has been criticized by not being able to control the third variable problem. In Tanzania, studies in both potential and actual creativity are still lacking even for comparison purposes. Future research in Tanzania might consider doing research on the general domain approach to improving performance in creativity.

CONCLUSION

This study assessed convergent thinking among secondary schools in Tanzania. An assessment was guided by three research questions. First, what is the difference in convergent thinking by school ownership? Second, what is the difference in convergent thinking by geographical location of the school? And third, what is the difference in convergent thinking by Sex? From the findings of this study therefore, the following conclusions were made: first, convergent thinking varies with school ownership probably due to difference in the kind of thinking fostered by the owners of the school. Students from urban schools performed higher than students from rural schools in all components of convergent thinking probably due to variations in the problem situations they are exposed to. Third, sex difference was not consistent to all the components of convergent thinking. This was an indication that though such differences are not permanent and are diminishing.

Basing on past research, assessment was made around three variables which are school ownership, geographical location and sex. It was found that there was a statistical significant difference in divergent thinking with school ownership and geographical location; whereby students from urban schools scored higher than students from rural schools regardless of sex and school ownership in all components of divergent thinking. Regarding sex difference, it was found that while there was no significant difference between male and female students in the performance of mathematical insight tasks, male scored significantly higher than female students in spatial insight tasks. On the other hand, female students scored higher in verbal insight tasks than their counterpart males. Discussion is made in terms of both creativity research and practical implications in the context of school learning.

REFERENCES

Alan, F. (1988). Cognitive gender differences are disappearing. *American Psychologist, 43(2), pp. 95-103.* http://dx.doi.org/10.1037/0003-066X.43.2.95

Benbow, C.P. & Stanley, J.C. (1983). Seex differences in mathematical reasoning ability: more facts. *Science, 222, pp.1029-1031*.

Benbow, C.P., Lubinski, D., Shea, D. L., & Eftekhari-snjani, H. (2000). Sex differences in mathematical reasoning ability at age 13: their status 20 years later. *Psychological Science, 11(6), pp. 474-480. Doi:101111/1467-9280.00291.*

Bilalic, M., Smallbone, K., McLeod, P. & Gobet, F. (2008). Why are (the best) women so good at chess? Participation rates and gender differences in intellectual domains. *Proc. R. Soc. B, 276, 1161 – 1165. Doi:10.1098/rspb.2008.1576*

Carli, L.L., Alawa, L., Lee, Y., Zhao, B. and Kim, E. (2016). Stereotypes about gender and science: Women ≠ Scientists. *Psychology of Women Quarterly 2016, 40(2), 244-260.*

Danili, E. and Reid, N. (2006). Cognitive factors that can potentially affect pupils' test performance. *Chemistry Education Research and Practice, 7(2), 64-83.*

Dennett, D. (1978). Beliefs About Beliefs. *Behavioral and Brain Sciences, 4,* 568-570

Dow, G. T., & Mayer, R. E. (2004). Teaching students to solve insight problems: evidence for domain specificity in creativity training. *Creativity Research Journal, 16*(4), 389-402.

Gallagher, J.J. (1965).*The Influence of a Special School on Cognitive Style and Attitudes of Gifted Students*. Illinois Univ., Urbana. Inst. of Research for Exceptional Children.

Hyde, J.S., Linn, M. C. (1988). Gender differences in verbal ability: A meta-analysis. *Psychological Bulletin, 104(1), pp. 53-69.* http://dx.doi.org/10.1037/0033-2909.104.1.53

Joshua, J.M. (2014). The influence of students' experience in the past academic success on convergent thinking. *Ife Psychologia, 22(1), 159-169.*

Oettingen, G., Marquardt, M.K. & Gollwitzer, P.M. (2012). Mental contrasting turns positive feedback on creative potential into successful performance. *Journal of Experimental Social Psychology 48, 990-996.*

Runco, M.A (2004). Creativity. *Annual Review of Psycology, 55, 657- 68*. doi: 101146/annurev.psych.55090902.141502.

Santrock, J.W. (2004). *Educational Psychology*. Boston: Mcgraw-Hill.

Suddendorf, T. (1999). The rise of the metamind. In Corballis M. C. & Lea S. (Eds.). *The Descent of Mind Psychological Perspectives in Hominid Evolution*. New York: Oxford University Press.

Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press.

Vygotsky, L. S. (1986). *Thought and Language*. Cambridge, MA: MIT Press.

Wimmer, H., & Perrier, J. (1983). Beliefs about beliefs: representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition,* 13, 103-128.