

The Relationship between Divergent Thinking and School Performance among Secondary School Students in Tanzania

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Abstract

The purpose of this study was to explore the relationship between Divergent thinking and School performance among secondary school students in Tanzania. Twelve secondary schools in Dodoma region were categorized in two groups. Six schools were strategically drawn from the list of high performing schools and other six from the low performing list in the Form Four National Examinations. The two groups comprised of 444 secondary school students, of whom 217 were males and 227 were females; were exposed to the adopted Gilford's Alternate Uses Task (AUT, 1967). It was found that there was a statistical significant difference in divergent thinking between the subjects from high performing schools and those from low performing schools whereby on average subjects from high performing schools scored higher in divergent thinking than their counterparts from low performing schools.

Key words: School performance, Divergent thinking

1. Introduction

The purpose of this study was to explore the relationship between divergent thinking and school performance among secondary school students. For many years in Tanzania, school performance has been not so much promising and has been so acute in mathematics, science subjects, English language and geography (Omari, 2008; 2011a; Joshua, 2008, 2011b, 2014). One concern about school performance has been the tendency of consistent appearance of some schools among the group of high performing schools while on the other hand some schools have consistently appeared among the group of low performing schools in the Form Four National Examinations. The term school performance in this study has been used to mean this distinctive pattern of a school being positioned in a specific group which is either high or low performing in the form four national examinations. This pattern raises curiosity as to what makes difference in terms of students' cognitive processes and the teaching-learning practices within the classroom between high performing and low performing schools.

Previous studies (Idama & Ndabi, 1996; Chonjo & Welford, 2001) have associated school performance with variables such as insufficient school equipment, laboratories, libraries, poor teaching strategies, lack of exercise and practice among pupils, poor teaching and learning of key concepts, and misinterpretation of information. However, a critical observation of the previous explanations raise more curiosity because despite the efforts by the government to increase the number of qualified teachers, schools' equipment, alongside the improvement of the pupil teacher ratio; data has consistently shown a declining trend in academic performance.

In an attempt to satisfy such a curiosity a theory of school learning as expounded in Bloom (1976) was consulted. The theory is an approach that proposes some variables accounting for much of the variations in school learning. Two basic assumptions underlying this theory are first, the history of the learner is at the core of school learning; and second, it is possible to modify the characteristics of the learner during the instruction. The theory of school learning deals with three major variables. These are students' characteristics, instruction, and learning outcomes. According to Bloom, two major levels of student's characteristics that determine student learning are cognitive entry behaviors and affective entry characteristics. Cognitive entry behaviors refer to the prerequisite learning required for the learning tasks on which instruction is to be provided. Affective characteristics refer to the student's motivation to learn the new learning tasks. The instruction variables are defined in the theory as the quality of instruction. This is the extent to which the cues, practice, and reinforcements of the learning process are appropriate to the needs of the learner.

The theory states that the cognitive entry behaviors, affective entry characteristics, and the quality of instruction determine the nature of learning outcomes, which are the level and type of achievement, rate of learning, and affective outcomes. This means that, given favorable learner's entry characteristics and quality of instruction, all learning outcomes are likely to be at a high or positive level, and little variation in the learning outcomes.

Researches relating students' characteristics and specifically divergent thinking to school performance have revealed that divergent thinking might partly explain school performance elsewhere. For instance, divergent thinking has been related to final dissertation marks than to examinations and continuous assessment performance among 307 British university students (Chamorro-Premuzic, 2006); science among 92 sixth graders (Cohen, 2001); intelligence tests among 400 adults (Reese *et al.*, 2001); academic achievement among 153 Iranian undergraduate students in Malaysian Universities (Naderi *et al.*, 2009, 2010); pupils' performance in assessment formats where language was an important factor among 476 public upper secondary schools pupils in Greece (Danili and Reid, 2006); students' academic achievements among 256 students in Pakistan (Anwar *et al.*, 2012).

This study attempts to factorize divergent thinking as being analogous to student's cognitive behavior in the Bloom's theory of school learning. This is because the fact that some previous studies found the relationships between divergent thinking and school performance elsewhere raises the question as to whether or not such findings may explain school performance differences in Tanzania. Thus, this study intended to explore the relationship between divergent thinking and school performance in Tanzania.

1.1 Research Questions

This study intended to explore the relationship between school performance and divergent thinking. This was achieved by addressing three main questions: First, what is the distribution pattern of the uses of the items mentioned by the students? Second, what is the difference in divergent thinking between the group of high performing and the low performing schools? Third, in what component of divergent thinking do students from the group of high performing schools differ from the group of low performing schools?

2. Method

2.1 Subjects of the Study

This study was conducted among form four students in 12 secondary schools in Dodoma region in Tanzania. The schools were selected strategically selected to include both high and low performing schools for comparison purposes. The selection of schools further considered inclusion of both government and non-government schools in the sample. Further, schools selected were coming from both rural and urban areas. A sample of 444 form four students of whom about 48.9 percent (N=217) were males and 51.1 percent (N=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 implying that there was no big age variation as most ages clustered around the mean. Regarding physical location, subjects from urban schools were about 41.9 percent (N=186) while those from rural schools were about 58.1 percent (N=258).

2.2 Measures

After taking the background information upon the informed consent of the subjects, the subjects were exposed to The Gilford's Alternate Uses Task (AUT, 1967) whose directions were:

There are five items in this task for you. You have 10 minutes to respond to each item. Think aloud before you write your answer. Remember that there are no correct and wrong answers for this work. Thus, think and write whatever answer you consider relevant from your experiences. The more responses you can come up with the better; so write as many as possible.

Then subjects were allowed to start answering the test items. The test session took about 55 minutes. In this study, five items which are a drum, a piece of paper, a piece of an empty land, a tree, and a knife were adopted because of their familiarity by the target population. The instruments were originally written in English. To allow free thinking and any potential language barrier towards divergent thinking, 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 led to a careful choice of the items common to the areas of the study. For example, during translation of the instruments, in the Gilford's Alternative Uses Tasks, the term drum meant both *ngoma* and *pipa* to Kiswahili speakers.

The term drum for *ngoma* refers to a musical instrument made up of a skin stretched tightly over a round frame while the term drum for *pipa* refers to a large cylindrical container used to store liquid substances. To avoid confusion the term *pipa* was chosen because it is familiar as it is used by most people in Tanzania for storage of liquid materials, especially water.

In scoring divergent thinking, four components of the traits were identified. These are originality, fluency, flexibility, and elaboration. To score originality, each response was compared to the total amount of responses from all respondents. Responses given by five percent of the group were considered unusual and were awarded one point. Responses that were given by one percent of respondents were considered unique and were awarded two points. The unusual and unique responses were then totalized so that the higher the score the higher the creative thinking and the lower the score the lower the creative thinking in terms of originality.

Fluency was scored by just counting all the responses given by the individual respondent. In the example given above, fluency could be six. Flexibility was scored by categorizing the responses of the same nature. Lastly, elaboration refers to the amount of details provided by examinees to make their response clear to the reader or listener. The components of divergent thinking (Fluency, Flexibility, Elaboration, and Originality) were further re-categorized to separate the groups of low moderate and high scores in the same.

3. Results

3.1 Qn. 1: What is the Distribution Pattern of the Mentioned Uses of the Items by the Students?

Subjects were asked to mention the uses of the items such as drum, a piece of paper, a piece of an empty land, tree, and a knife. Tables 1, 2, 3, 4, and 5 presents the distribution pattern of the uses mentioned.

3.1.1 The Mentioned Uses of the Drum

Table 1: The Mentioned Uses of the Drum

Uses	Total Responses	
	Frequency	Percent
<i>To store liquid substances such as water and petroleum</i>	444	100
<i>To ferment local alcoholic drinks</i>	311	70.05
<i>To store foods such as corns, millet and dry cassava.</i>	151	34.00
<i>To recycle and make other iron tools like cooker, bucket, frying pan, and dishes.</i>	130	29.30
<i>To stand on it as a ladder to help reach high objects</i>	127	28.60
<i>To cook foods like ugali in it for many people</i>	113	25.45
<i>To boil water</i>	93	20.95
<i>To boil the tarmac in it</i>	19	4.28
<i>To burn waste materials</i>	11	2.50
<i>To sail on it (travel by water)</i>	8	1.80
<i>To hide oneself in it</i>	8	1.80
<i>To make a loud speaker</i>	4	0.90

Table 1 indicates that two uses of a drum which are ‘to store liquid substances such as water and petroleum’ and ‘to ferment local alcoholic drinks’ were mentioned by 70 percent (N=311) and 100 percent (N=444) of the subjects respectively. On the other hand, unusual responses were ‘to boil the tarmac in it’, ‘to burn waste materials’, ‘to sail on it (travel by water)’, ‘to hide oneself in it’, while the unique response was ‘To make a loud speaker’.

3.1.2 The Mentioned Uses of a Piece of Paper

Table 2: The Mentioned Uses of a Piece of Paper

Uses	Total Responses	
	Frequency	Percent
<i>To write</i>	429	96.62
<i>To lit fire</i>	274	61.71
<i>To wrap or enclose commodities bought</i>	146	32.88
<i>To print pictures</i>	168	37.84
<i>To erase written words on the chalk board</i>	118	26.58
<i>To make decorations</i>	100	22.52
<i>To keep records</i>	83	18.69
<i>To make cigarettes</i>	36	8.11
<i>To make laboratory experiments e.g. differentiating color,</i>	22	4.95
<i>To measure distance on maps</i>	13	2.92
<i>To hold hot objects</i>	11	2.48
<i>To fill or seal the holes on the wall</i>	8	1.80
<i>To sit on to avoid dust</i>	7	1.58
<i>To make teaching aids</i>	5	1.13
<i>To vote with</i>	5	1.13
<i>To fan or breeze oneself when it is hot</i>	3	0.68
<i>To make money</i>	1	0.23
<i>To clean one's ears</i>	1	0.23
<i>To label samples or animals</i>	1	0.23

From Table 2, most subjects about 96.62 percent (N=429) said they would use a piece of paper to write and about 61.71 percent (N=274) mentioned to lit fire. On the other hand, the unique responses mentioned were ‘to fan or breeze oneself when it is hot’, ‘to make money (notes)’, ‘to clean one’s ears and to label samples or animals’.

3.1.3 The Mentioned Uses a Piece of an Empty Land

Table 3: The Mentioned Uses of a Piece of an Empty Land

Uses	Total Responses	
	Frequency	Percent
<i>To cultivate /for agriculture</i>	414	93.24
<i>To build settlements</i>	379	85.36
<i>To make business</i>	129	29.05
<i>Construct playing grounds</i>	162	36.49
<i>To conserve natural ecosystem</i>	108	24.32
<i>To graze animals or stocks</i>	75	13.29
<i>To construct roads and railways</i>	59	13.29
<i>As a meeting square</i>	41	9.23
<i>To dig minerals</i>	36	8.10
<i>To beautify the landscape</i>	31	6.98
<i>To bury dead bodies</i>	16	3.60
<i>To quarry building materials like sand, and stones</i>	12	2.70
<i>To lay crops for drying purpose</i>	3	0.68
<i>To damp wastes</i>	1	0.23

Table 3 indicates that two uses of a piece of an empty land which are ‘to cultivate / for agriculture’ and ‘to build settlements’ were mentioned by about 93.24 percent (N=414) and 85.36 percent (N=379) of the subjects respectively. On the other hand, the unique responses mentioned were ‘to lay crops for drying purpose’ (0.68 percent; N=3) and ‘to damp wastes’ (0.23 percent; N=1).

3.1.4 The Mentioned Uses of Tree

Table 4: The Mentioned Uses of Tree

Uses	Total Responses	
	Frequency	Percent
<i>To make firewood and charcoal</i>	362	81.53
<i>To cool the weather by providing breeze</i>	357	80.40
<i>To make building materials</i>	283	63.74
<i>To construct furniture</i>	233	52.48
<i>To collect food and fruits</i>	232	52.25
<i>To make timber</i>	212	47.75
<i>To collect medicine</i>	157	35.36
<i>To beautify surroundings</i>	119	26.80
<i>To keep bees</i>	88	19.82
<i>To stop storms or rough winds</i>	58	13.06
<i>To grind maize, millet cassava etc.</i>	47	10.59
<i>To make papers</i>	47	10.59
<i>To make weapons like a stick or gun</i>	15	3.38
<i>To make electrical posts</i>	9	2.02
<i>To make tourism attraction</i>	6	1.35
<i>To construct a bridge</i>	5	1.12
<i>To make clothes</i>	4	0.90
<i>To make matchbox</i>	3	0.68
<i>Children play on it by flinging around</i>	3	0.68
<i>To rescue a person from electrical shock</i>	2	0.45
<i>To make decorations like sculptures or images</i>	2	0.45
<i>To make soap</i>	2	0.45
<i>To rest under the tree shade</i>	2	0.45
<i>To hide on</i>	1	0.23
<i>To make a boat</i>	1	0.23
<i>To help reach and bring down high object</i>	1	0.23

According to Data in Table 4, two uses were mentioned by most subjects. These are: 'to make firewood and charcoal (81.53 percent; N=362) and to cool the weather by providing breeze (98.40 percent; N=357). On the other hand, the unique responses mentioned were 'to to hide on,' 'to make a boat', and 'to help reach and bring down high object'.

3.1.5 The Mentioned Uses of a Knife

Table 5: The Mentioned Uses of a Knife

Uses	Total Responses	
	Frequency	Percent
<i>As a weapon</i>	240	54.05
<i>To cut things into pieces</i>	417	93.92
<i>To dig small holes</i>	49	11.04
<i>To make decorations like sculptures or images</i>	30	6.78
<i>To tighten and loose nuts in absence of spanner</i>	22	4.95
<i>To label cattle</i>	2	0.45
<i>To decorate</i>	1	0.23
<i>To sell and get money</i>	1	0.23

From Table 5, the common use mentioned by about 93.92 percent (N=417) was to cut things into pieces while the unique uses were such as to label cattle (0.45 percent; N=2), 'to decorate (0.23 percent; N=1) and to sell and get money (0.23 percent; N=1).

3.2 Qn. 2: What is the difference in divergent thinking between the group of high performing and the low performing schools?

The difference in divergent thinking between the group of high performing and that of low performing schools was determined by performing an independent t-test. Table 6 presents the results.

Table 6: Differences in Divergent Thinking by School Performance

School Quality	Descriptives		<i>t</i>		Sig. (2-tailed)	Mean Difference		Effect size
	Mean	S.D	Lower	Upper		Lower	Upper	
High Performing Schools	54.32	23.92	7.78	383.86	.000	38.12		$r = 0.37$
Low Performing	39.01	16.63						

Data in Table 6 indicates that on average, subjects from the group of high performing schools performed higher in divergent thinking (Mean = 54.32) than their counterparts from the group of low performing schools (Mean = 39.01). The difference was significant $t(437) = 2.85$, $P < .05$ at a moderate magnitude of difference as represented by effect size of $r = .37$. This might be interpreted that in a small magnitude, students from high performing schools were more divergent thinkers than students from the group of low performing schools.

3.3 Qn. 3: In what component of divergent thinking do students from the group of high performing schools differ from the group of low performing schools?

Descriptive data such as frequencies and percentages were calculated for each group separately by splitting the file to see the specific components of divergent thinking in which the difference originated. Table 7 presents the results.

Table 7: Difference in the Components of Divergent Thinking by School Performance

Fluency					
Score category	High Performing School		Low Performing School		
	Frequency (N)	Percent	Frequency (N)	Percent	
Low Fluency (< or= 20)	70	32.1	140	61.9	
Moderate Fluency (21- 40)	120	55.0	75	33.2	
High Fluency (> or = 41)	28	12.8	11	4.9	
Total	218	100.0	226	100.0	
Flexibility					
Score category	High Performing School		Low Performing School		
	Frequency (N)	Percent	Frequency (N)	Percent	
Low Flexibility (< or= 10)	13	6.0	50	22.1	
Moderate Flexibility (11- 20)	150	68.8	166	73.5	
High Flexibility (> or = 21)	55	25.2	10	4.4	
Total	218	100.0	226	100.0	
Elaboration					
Score category	High Performing School		Low Performing School		
	Frequency (N)	Percent	Frequency (N)	Percent	
Low Elaboration (< or= 10)	179	82.1	208	92.0	
Moderate Elaboration (11- 20)	7	3.2	5	2.2	
High Elaboration (> or = 21)	32	14.7	13	5.8	
Total	218	100.0	226	100.0	
Originality					
Score category	High Performing School		Low Performing School		
	Frequency (N)	Percent	Frequency (N)	Percent	
Low Originality (< or= 10)	69	31.7	109	48.2	
Moderate Originality (11- 20)	67	30.7	75	33.2	
High Originality (> or = 21)	81	37.2	41	18.1	
Missing	1	.5	1	.4	
Total	218	100.0	226	100.0	

Data in Table 7 indicates that in all of the components of divergent thinking, subjects from high performing schools scored relatively higher than subjects from low performing schools.

4. Discussion

It has been observed that most subjects were not divergent thinkers as they tended to mention common uses. On the other hand whereas the mentioning of unusual and unique uses of the items was not a property of high performing school group, the numbers of the unusual and unique uses were higher in the group of high performing schools relative to the group of low performing schools. Such a distribution pattern might have something to do with the fact that some students from the high performing schools were also coming from different parts of the country where some uses of the items they mentioned were practiced. This might lead to the reasoning that exposure and experience in a particular field has something to do with creativity in the relevant field.

The findings have further indicated a significant difference in divergent thinking between students from high performing schools and their counterparts from low performing schools. Students from high performing schools demonstrated relatively high ability of divergent thinking than their counterparts from low performing schools. This is an indication that there is a relationship between divergent thinking and school performance. These findings are consistent with the findings by other studies such as Chamorro-Premuzic (2006); Cohen (2001); Reese *et al* (2001); Naderi *et al* (2009, 2010); Danili and Reid (2006); and Anwar *et al* (2012); all of whom found the relationship between academic performance and divergent thinking. However, all the studies referred here were conducted elsewhere outside Tanzania. Though, there were no similar studies in Tanzania to compare with; the sample size used in this study and the findings from other similar previous studies are indication that divergent thinking has something to do with schooling in Tanzania.

However, these findings face one potential limitation that might be taken cautiously before making any generalization. The study just picked students from the schools which had been listed as low or high performing. It should be taken into consideration that categorization of the schools is mainly based on the average score of the school in the performance in Form Four Examinations. This implies that not all students in the classes or schools are equally intelligent or having the same cognitive abilities necessary for passing or failing in the examinations. This study did not investigate academic performance of individual students in the schools but a school category where students who took divergent thinking test came from. This might affect the results of another study in the same schools with the same students if the dependent variable changed into specific marks individual students scored in the examinations.

Despite such limitation, in the light of the findings of this study one might confidently discuss the potential practical application of divergent thinking in the school learning and ultimately performance. Education presented in a divergent way of thinking can produce problem solvers, people with the ability to come up with insight solutions for the difficulties facing the society at the time of need - divergent thinkers! Divergent thinking is not only for solution seeking but also it has been associated with academic success. Divergent thinking is thus, a crucial element one needs in designing as many as possible ways of presenting learning materials for the students to enable understanding.

On the other hand, divergent thinking among students enables them to face learning and academic problems from as many alternative angles as possible. This does not mean that teachers need to foster to students divergent thinking alone because it is not the only and sufficient factor for learning. However it is a way that can help students come up with other ways to solve practical issues facing them in the studies and in the communities and society at large. When students are equipped with both divergent and convergent thinking abilities they become more flexible to apply the appropriate thinking ability when faced by a novel problem or challenging task that needs their thinking. This is because in daily life, humans are surrounded by challenges, whose nature requires solutions of different approaches of thinking.

On their side, students may apply divergent thinking in learning several alternatives to tackle similar problems in different contexts or new problems that they never experienced before. They may also apply convergent thinking to come up with the correct way to address the problem which must be solved but which students never came across. For example, in their learning, students are exposed to different academic problems, which their teachers guided them to solve through given examples.

When they come across similar questions with different formulation requiring their application, analysis, synthesis or evaluation in the examinations, most students fail to apply their thinking, fail to solve the problems, claiming that they have never been taught what they are being asked in examinations. Such problem could be easily tackled if students were exposed to divergent thinking tasks that could develop their abilities to think beyond examples given in the class.

Students, whose minds were nurtured to perfectly think creatively, might apply creative thinking beyond academic learning to see more life opportunities even after they complete their studies. In Tanzania today, the increase of universities have come with new challenges of unemployment among university graduates. Month after month, these graduates walk in the offices seeking for formal employment in the government and private sectors. On the other hand, self employment in the informal sector is left in the hands of people without formal education, implying that these graduates were not prepared to utilize their creative thinking abilities beyond the learning contexts. They cannot think and come with alternatives to address new life after schooling without being formally employed for salary gains.

The common practice in Tanzania is that education, which starts at homes, usually puts emphasis on obedience to parents and other elders in the community. This automatically forces children to trust adults and mistakenly believe that these parents and adults are infallible. Even when exposed to school life, students are introduced to certain pseudo facts and the so called 'right' answers by their teachers. These early practices potentially lead children to believe that imaginations, intuitions, criticisms, and different opinions are associated with arrogant people who are likely to be punished. It is not until children reach higher learning institutions, when university lecturers insist that learners in higher learning institutions should be critical and creative thinkers. This emphasis usually appears strange to students whose entire life in education has been that of returning to teachers the 'right answers' in a word to word form, of which small mistakes in memorization lead to a negative feedback in a form of a wrong mark (Stevens, 2000).

Showing discontent with the education systems similar to that in Tanzania and emphasizing the need to inculcate in students the highest degree of understanding Gardner (1991) remarks,

...even when school appears to be successful, even when it elicits the performances for which it has apparently been designed, it typically fails to achieve its most important mission. ...investigations document that even students who have been well-trained and who exhibit all the overt signs of success - faithful attendance at good schools, high grades and high test scores, accolades from teachers - typically do not display an adequate understanding of the materials and concepts with which they have been working (p.5).

The quotation indicates how Gardner is insisting the need to aim at deeper understanding by the learners instead of superficial learning which is usually a characteristic of most students in our school systems. This does not mean that facts and correct answers do not exist or that students should not cram the facts or correct answers. Indeed, these are the basic skills as means in developing higher order thinking abilities but not in themselves the end. In addition, this system might continue to benefit the few whose opinions and point of view are matching those of their teachers and close the doors for those with constructive thoughts that do not necessarily match their teachers.'

Marshall and Tucker (1992) argues that the future now belongs to societies that organize themselves for learning and that nations that want high incomes and full employment must develop policies that emphasize the acquisition of knowledge and skills by everyone, not just a select few. This thesis argues for the need to incorporate and sustain creative thinking that exist in children and develop them throughout their school experience, for meaningful tangible outcomes of education in the education practices of Tanzania.

Regarding the potential implications for the theory of school learning is that divergent thinking is a cognitive behavior, which needs to be intermingled with the quality of instructions accelerate the rate of both individual and school performance. However, this study did not exhaust the constructs of the Bloom's theory of school learning. A lot of the constructs still need to be studied together so as to check the applicability of the theory in school performance in Tanzania.

5. Conclusions

This study intended to explore the relationship between school performance and divergent thinking. To achieve the purpose of the study, three main research questions were addressed: First, what is the distribution pattern of the uses of the items mentioned by the students? Second, what is the difference in divergent thinking between the group of high performing and the low performing schools? Third, in what component of divergent thinking do students from the group of high performing schools differ from the group of low performing schools? In the light of the literature reviewed and data from this study therefore two main conclusions can be reached: First, divergent thinking as measured by the Guilford's Alternate Uses Task (AUT, 1967) seems to be determined by exposure, experience and the geographical location where the subjects might have interacted with the item in question. Second, though there is a relationship between divergent thinking and school performance; students who perform higher in divergent thinking are also likely to perform higher in academics though not many students performing higher in academics are likely to perform higher in divergent thinking.

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