

The Relationship between Convergent Thinking and School Performance among Secondary Schools in Tanzania

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ABSTRACT

This research aimed at investigating the relationship between convergent thinking and school performance among secondary schools in Tanzania. About 444 students were categorized basing on their school rank in Form four national examinations. The groups were students from high performing schools group (N=218) and students from low performing schools group (N=226). The two groups were then compared in their scores of convergent thinking test. Specifically, two research questions were addressed. First, what is the difference in convergent thinking between students from high performing schools and students from low performing schools? To what extent could convergent thinking explain school performance when other variables such as sex, school ownership and geographical location are controlled for? An independent t-test revealed that students from the high performing schools group scored higher in all components of convergent thinking than students from the low performing schools group. It was further found that school ownership and geographical location were crucial confounding variables in the relationship between convergent thinking and school performance. While school ownership was the strongest predictor of school performance, only mathematical insight tasks component of the convergent thinking made uniquely significant contribution in the school performance. Both practical and theoretical implications are discussed as well as potentials for future research.

Keywords: *Convergent Thinking in Tanzania; School Performance in Tanzania; School Performance and Convergent Thinking; School Ownership; Geographical Location of the Schools.*

1. INTRODUCTION

This research aimed at investigating the relationship between convergent thinking and school performance among secondary schools in Tanzania. 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. On the other hand, school performance refers to school's position in the national rank on the basis of form four examination results. This research was triggered by the observed school performance pattern in Tanzania. In the country there is a practice of listing schools basing on their examination results from the highest to lowest performer. Surprisingly, some secondary schools have been consistently appearing in the list of high performing schools while on the other hand some have consistently appeared among the group of low performing schools. In the form six results in 2016 for example, the pattern was characterized by another important variable to note, which is sex. This is because the schools that fell in the 'top ten' category were both government and non-government but were either 'only females' or 'only males' schools. This pattern raised 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. The theory of school learning gave the way to proceed as described in the next paragraphs.

The Bloom's (1976) Theory of School Learning

The theory of school learning proposes some variables that account for much of the variations in school learning. According to the theory, cognitive entry behaviors, affective entry characteristics, and the quality of instructions determine the nature and type of learning outcomes. The theory assumes that the history of the learner is the core of school learning, and that there is a possibility to modify the characteristics of the learner through designed instructions. Two major student's characteristics that determine student learning are cognitive entry behaviors and affective entry parameters. Cognitive entry behaviors refer to the prerequisite learning required for the school learning tasks on which instructions should be designed for the best match. Affective characteristics refer to the student's motivation to learn the new school learning tasks. Instruction variables are defined as the extent to which the cues, practice, and reinforcements of the learning are appropriate to the needs of the learner (Bloom, 1976). This theory is relevant to this study as it addresses both cognitive and social aspects of the learner. What takes place in the schools of Tanzania whose structure is not homogenous in nature, and what takes place in the students' thinking might be understood in the basis of the theory of school performance. Convergent thinking in this study was placed as an analogue to cognitive characteristic of the students to be assessed along with other school characteristics to explain school performance.

Describing the categories of secondary schools in Tanzania, Joshua (2014) summarizes that:

“...students who achieve relatively higher in examination results are usually placed in the best traditional government schools. In these schools there is good learning climate such as text and reference books, libraries, laboratories, sufficient number of teachers, residential houses for teaching members of staff, etcetera. Some non-government specifically religious schools and few private schools follow in terms of quality of school environment while community schools are usually poor in the same. It follows then that students who are comparable good in terms of academic success but do not get chance to the traditional government schools are enrolled in the community schools. However, those whose parents are capable economically, make a deliberate decision to enroll their children to the best religious or private schools, where it is believed that these children will learn better than in the community schools. The community schools therefore, comprise students of two kinds. First, those who are moderately good but their parents are not economically capable and second, those whose academic success is relatively poor. On the other hand, there is a location difference of these schools. There are schools of all three kinds in urban districts and in rural districts” (pg.9).

From this summary two variables are described that might explain school performance in Tanzania. These are type of school in terms of school ownership and geographical location. Investigation of the relationship between convergent thinking and school performance sought to address the following questions: First, what is the difference in convergent thinking between students from high performing schools and students from low performing schools? To what extent could convergent thinking explain school performance when other variables such as sex, school ownership and geographical location are controlled for?

Convergent Thinking and School Performance

The relationship between convergent thinking and school performance has been discussed by researchers in various ways. For instance, Bandura (2000) relates past school performance to a single-minded persistence which is useful in overcoming obstacles. On the other hand, Audia, Locke, and Smith (2000) argue that such a single-minded persistence might be harmful in the face of environmental changes that require new strategies necessary for survival. Other researchers linking past school performance with convergent thinking are such as Gongalo (2004) who found a positive and significant relationship between past school performance and convergent thinking among 160 students at a large North-American university; Likewise, Sak and Maker (2003) found that mathematical reasoning tasks accounted for 29 percent of the overall variance in school performance and in general convergent thinking correlated positively and significantly with performance in science subjects among grade six students. Sak and Maker (2005) further found moderate and positive correlations between convergent thinking and achievement in mathematical tasks. Similar findings are reported by Nezhad and Shokpour (2013) who used a Multivariate ANOVA to indicate that the best results were

achieved when divergent thinkers of the divergent task type group answer referential, and multiple-response items whereas the worst results were obtained when convergent thinkers in the convergent task group's performance on multiple-response items was used as the criterion for reading assessment. The researchers further found that a task-based course of instruction through convergent or divergent tasks cause the participants to have respectively lower or higher gains on the convergent thinking test respectively.

Other Determinants of School Performance

Despite cognitive determinants of school performance, other determinant variables have been discussed in the empirical literatures. For example, Malaspina and Rimm-Kaufman (2008) reports that non-white male students whose mothers attained low levels of education demonstrated a steep decline of school performance than their counterparts at the first transition from one level of education to the next. They further argue that the presence of numerous school transitions may constitute one additional stressor for students who are already at risk for school failure. Likewise, Jimerson et al., (1999) found that higher socioeconomic status was associated with higher performance in academics across the year. Such variables as socioeconomic status and students' color or minority; though empirically evident in USA and probably in other developed countries, might not directly be applicable in Tanzania because of the nature of socioeconomic structure experienced in Tanzania. Although the difference between the poor and the rich is sharply increasing, control by the government has been protecting the impact of such differences in education. However, the clear pattern of socioeconomic variation can well be described in terms of school ownership and physical location of the school. Kurlaender and Reardon (2008) found that standardized assessments, timing of algebra and course failures in middle school provide useful indication of students' high school academic success.

In Nigeria, Ubaka, Sansgiri, and Ukwe, (2015) report that test anxiety was negatively associated with school performance. In addition, test competence, academic competence, and time management significantly discriminated between the lower and higher performing students and were positively associated with school performance. In Australia, Birch and Miller (2005) reports prior academic ability, level of wealth and demographic traits as determinants of school performance among university performance and adds that university grades are largely influenced by students' university entrance scores and the characteristics of the school one attended. In Pakistan, Talib and Sansgiry (2012) report that academic competence, test competence, time management, and test anxiety were significantly related to student's school performance and that the same factors were the major discriminators among low and high GPA achievers.

Studies in Tanzania provide a vivid picture on the contextual variables associated with school performance in the country. Mlozi, Kaguo, and Nyamba (2013) found that school performance of secondary schools built by the community were poorer than government built secondary schools in Form II and IV national examinations. They attributed such differences to insufficient teaching and learning materials, poor teaching and learning processes especially in the community built secondary schools, the greater number of

students than the learning facilities available, and code switching and mixing of English with Kiswahili during teaching. David (2014) found that poor school performance in day secondary schools in Sumbawanga district was associated with low parents' income, lack of laboratories and long walking distances to schools, incompetence in English language, inadequate teaching and learning materials, inadequate number of teachers and unavailability of library facilities.

2. METHOD

2.1. Respondents

The Insight Problems tasks test was given to 580 form four secondary school students who were selected from twelve secondary schools, six from one urban district and six from one rural district in Tanzania. The criteria for inclusion were 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.

2.2. Measures

I adopted the Insight Problems tasks (Dow & Mayer, 2004) to measure convergent thinking. The Insight Problems tasks is a test categorizing convergent thinking into three tasks categories such as mathematical insights, verbal insights, and spatial insights. The test is normally comprised of about 65 tasks measuring mathematical insights, 40 tasks measuring verbal insights, and 16 tasks measuring spatial insights. In this study, I randomly picked five items from each tasks category making a total of 15 items in total. I administered the test to two groups of students separately. The first group was students from high performing schools (N=218) and the second was the group from the low performing schools (N=226). Each group was followed in their respective schools so that there was no communication between students from low performing schools and students from high performing schools. I scored the test by awarding one point for every correct response. I then totalized the correct items for each 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.

3. RESULTS

3.1. The Difference in Convergent Thinking between Students from High Performing Schools and Students from Low Performing Schools

A t-test for independence was performed to study the difference in convergent thinking between students from high performing schools and students from low performing schools. Table 1 presents the results.

Table 1: School Performance and Convergent Thinking

| Category of Convergent Thinking | School Ranking Group | Descriptive Data | | t-test for equality of means | | | | |
|-----------------------------------|------------------------|------------------|------|------------------------------|--------|-----------------|-----------------|-------------|
| | | Mean | S.D | t | df | Sig. (2-tailed) | Mean Difference | Eta Squared |
| <i>Mathematical Insight Tasks</i> | <i>High Performing</i> | 1.64 | .91 | 4.81 | 442 | .000 | .403 | 0.05 |
| | <i>Low Performing</i> | 1.24 | .87 | | | | | |
| <i>Verbal Insight Tasks</i> | <i>High Performing</i> | 1.28 | 1.11 | 2.94 | 426.02 | .003 | .289 | 0.02 |
| | <i>Low Performing</i> | .99 | .95 | | | | | |
| <i>Spatial Insight Tasks</i> | <i>High Performing</i> | 1.75 | .92 | 3.45 | 442 | .001 | .301 | 0.03 |
| | <i>Low Performing</i> | 1.45 | .92 | | | | | |

As indicated in table 1, there were significant differences in all three categories of convergent thinking between students from low performing schools (N=226) and their counterparts from high performing schools (N=218). This means that on average, students from high performing school were good in convergent thinking than students from low performing schools. However, the magnitudes of differences were quite small as exemplified by the eta squared measures.

3.2. Explaining School Performance from Convergent Thinking

To check the power of convergent thinking in explaining school performance, direct logistic regression analysis was performed to assess the influence of variables such as sex, school ownership, and geographical location of the school on

the likelihood that the school would be in a group of low performing school. The model was comprised of a number of determinant variables such as sex, school ownership, and geographical location of the school, Mathematical insight tasks, verbal insight tasks, and spatial insight tasks. The model containing all determinant variables was significant, $\chi^2(7, N = 444) = 94.59, p < .001$, indicating that the model was able to distinguish between low performing schools and high

performing schools. The model as a whole explained between 19.2% (Cox and Snell R square) and 25.6% (Nagelkerke R squared) of the variance in school performance, and correctly classified 76.1% of low performing group. Table 2 shows the contribution of each determinant variable to the school performance.

Table 2: Explaining School Performance from Convergent Thinking

| | | Variables in the Equation | | | | | | | |
|---------------------|-------------|---------------------------|-----|-------|----|------|---------------------------|--------------------|-------|
| | | B | S.E | Wald | df | Sig. | Exp(B) (Odds Ratio) | 95% C.I.for EXP(B) | |
| | | | | | | | | Lower | Upper |
| Step 1 ^a | Sex(1) | .13 | .25 | .27 | 1 | .607 | 1.136 | .698 | 1.850 |
| | Owner | | | 31.17 | 2 | .000 | | | |
| | Owner(1) | .99 | .33 | 9.10 | 1 | .003 | 2.705 | 1.417 | 5.165 |
| | Owner(2) | 1.39 | .25 | 30.60 | 1 | .000 | 4.013 | 2.453 | 6.566 |
| | Location(1) | .89 | .26 | 11.61 | 1 | .001 | 2.440 | 1.461 | 4.076 |
| | Mathtask | -.30 | .13 | 5.05 | 1 | .025 | .744 | .576 | .963 |
| | Verbaltask | .01 | .12 | .01 | 1 | .937 | 1.009 | .806 | 1.263 |
| | Spatialtask | -.153 | .12 | 1.499 | 1 | .221 | .858 | .671 | 1.096 |
| | Constant | -.703 | .39 | 3.099 | 1 | .078 | .495 | | |

a. Variable(s) entered on step 1: Sex, Owner, Location, Mathtask, Verbaltask, Spatialtask.

Table 2, indicates that only three of the determinant variables made a unique statistically significant contribution to the model. These are school ownership, geographical location and mathematical insight tasks. The strongest determinant school performance was school ownership, recording an odds ratio of 4.01. This means that students in private schools were over 4 times more likely to be in a group of low performing schools than students from government and community schools, controlling for all other factors in the model. Location of the school followed by recording an odds ratio of 2.44; meaning that students from rural schools were 2 times more likely to be in a group of low performing schools than their counterpart students from urban schools. Lastly, mathematical insight tasks explained school performance by recording an odds ratio of .58. This ratio being less than 1 with a $B = -.30$, indicates that students who performed high in mathematical insight tasks were .58 times less likely to be in a group of low performing schools, controlling for other variables in the model. Other variables such as sex, verbal insight tasks, and spatial insight tasks did not make any unique statistically significant contribution to the model.

4. DISCUSSION

The findings of this study indicate that students from high performing school scored higher in convergent thinking than students from low performing schools. However, when other variables such as school ownership, geographical location of the school and sex were controlled for, only one component of convergent thinking namely; mathematical insight tasks was able to predict school performance. This implies that though convergent thinking determines school performance, it is not the only and sufficient variable explaining school performance in Tanzania. In fact, school ownership proved to be the strongest predictor of school performance followed by location of the school in the equation that included convergent thinking. These findings are in the same line with other previous findings (Bandura, 2000; Audia, Locke, and Smith, 2000; Gongalo, 2004; Sak and Maker, 2003; 2005) all of who reported the relationships between convergent thinking and school performance.

Regarding school ownership and geographical location of the school being predictors of school performance, the findings are consistent to other studies in Tanzania (Mlozi, *et al*, 2013; David, 2014) who found that school performance of secondary schools built by the community were poorer than government built secondary schools in Form II and IV national

examinations. However, one asks oneself as to what is associated with the type of school so much so that it determines school performance. Available studies in Tanzania (Ibid.) might throw light in this question as they went far to attribute such differences to insufficient teaching and learning materials, poor teaching and learning processes especially in the community built secondary schools, the greater number of students than the learning facilities available, and code switching and mixing of English with Kiswahili during teaching.

Yet, making such generalizations about the characteristics of the schools that explains the prediction of school performance by school ownership should cautiously be received. For example, code switching and mixing in a bilingual classroom such as the ones in Tanzania is a common characteristic in most government schools, which have proved to be in a group of high performing schools than private schools, which are usually strict to English speaking. On the other hand, it is critically argued here that language is a medium of transmitting knowledge, regardless of what language it is, provided it is clearly known to users such as teachers and students. The use of either English or Kiswahili in bilingual nation like Tanzania if saves the purpose to make students understand the learned material should not be negatively taken by educationists and researchers until it is empirically and objectively proved to make difference in learning outcome in systematic and strict studies that control all necessary confounding variables in determining school performance.

4.1. Potential Application of the Findings in Secondary Schools

In the light of the previous studies (Gongalo, 2004; Joshua, 2014), it seems convergent thinking has something to do with school performance and especially past academic performance. Could it be that in the high performing schools convergent thinking is fostered than in the low performing schools? Or could it be that the experience of high academic performance has led students in high performing schools to think convergent? Though these questions are beyond the scope of this article, they are potential research questions to address in the future research and presentations. These findings might raise an argument that the nature of Form four examinations in Tanzania are set to demand single responses so that students must correctly respond to the same in a particular way for them to pass. However, since the convergent thinking was measured using insight tasks and not the taught formulae, there seem useful potential abilities that might be developed into creativity among students. Despite requiring a single response, students might be trained to approach questions that demand their thinking and useful application of insights to reach a single solution in their daily learning. This way, if students are inclined toward thinking to reach solution instead of just cramming the responses, convergent thinking might be productive and beneficial to the world of problem solving. Thus, the nature of examination questions must target deep thinking instead of placing high demands upon students, without necessarily employing any thinking, to reproduce a word to word response from the lecture notes. When students are equipped with convergent thinking abilities they become more flexible to apply the same when faced by a novel problem or challenging task that needs their though innovation. This is because in daily life, humans are surrounded by challenges,

whose nature requires solutions that have not been necessarily experienced before. Marshall and Tucker (1992) argue that the future now belongs to societies that organize themselves for learning; and those 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 article argues for the need to incorporate and sustain creative thinking that exists in children and develop them throughout their school experience, for meaningful tangible outcomes of education in the education practices of Tanzania.

With regard to theoretical implications, the findings of this study indicate that although students from high performing schools performed better in convergent thinking than students from low performing schools, school ownership and geographical location were stronger than convergent thinking in predicting school performance when all other variables in the equation were controlled for. This implies that different types of schools might offer different quality of instructions the same way students from urban might differ in what they are exposed in their school experience. These findings are supportive of the applicability of the theory of school learning in the context of secondary schools in Tanzania. Like in the theory, the findings of the present study suggest that though convergent thinking determines school performance it is not the only and sufficient determinant variable of school performance. Since convergent thinking in this study was placed as an analogue to cognitive characteristic of the students to be assessed along with other school characteristics to explain school performance; the theory seem to explain school learning outcomes in the context of Tanzania in fair perspective.

4.2. Limitations and Potential for Future Studies

No manipulation of variables was done but the variables were rather measured in this study. Future research may plan experimental studies that manipulate the same variables. Collection of data was done concurrently. To do much better in the studies using the theory of school learning future studies might plan a study measuring subsequent learning after measuring cognitive behavior. Future studies might also do better in the studies of this nature if all constructs of the theory are studied together in a single project.

5. CONCLUSIONS

This research aimed at investigating the relationship between convergent thinking and school performance among secondary schools in Tanzania. Investigation of the relationship between convergent thinking and school performance sought to address two questions which were: First, what is the difference in convergent thinking between students from high performing schools and students from low performing schools? To what extent could convergent thinking explain school performance when other variables such as sex, school ownership and geographical location are controlled for? From the research findings therefore, three conclusions were reached. First, convergent thinking is the cognitive determinant of the school performance; Second, school ownership and geographical location of the school are crucial variables to be included in the model of research studying determinants of school

performance; and third, though convergent thinking is a cognitive determinant of school performance, it is not the only and sufficient variable that explains school performance in Tanzania.

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