

Exploring the Distribution of Eight Executive Function Skills among Pupils in Grant-Aided and Non-Grant-Aided Secondary Schools

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ABSTRACT

The study explored the distribution of eight executive function skills, namely: working memory ability, task initiation ability, self-control ability, planning ability, organisation ability, metacognition ability, response inhibition ability and flexible thinking ability among grade eleven pupils ($N = 115$) from two grant-aided secondary schools (*SSGTA and SSCC*, $n = 52$) and two non-grant-aided secondary schools (*SSWB and SSKR*, $n = 63$) in Kabwe town in central province in Zambia. The study used a quantitative survey research design to investigate whether there was a statistical difference in the strength of the said eight executive function skills between pupils in the grant-aided schools and the non-grant-aided secondary schools. A convenience sampling strategy was used to select participants. Participants were enlisted in the study on a voluntary basis. A self-administered behavioural rating seven-point Likert scale was used by participants to rate the strength of their executive function skills. Using a statistical package for social sciences, data was analysed using an independence sample t – test. The findings revealed that there was not a significant statistical difference in the strength of six out of eight of the self-reported executive function skills, namely: working memory ability, task initiation ability, planning ability, organisation ability, metacognition ability and flexible thinking ability between pupils from the grant-aided secondary schools and non-grant-aided secondary schools. There was, however, a significant statistical difference in the strength of two self-reported executive function skills, namely self-control ability and response inhibition ability, between pupils from the grant-aided secondary schools and non-grant-aided secondary schools. Pupils from the grant-aided secondary schools reported stronger self-control ability and response inhibition ability compared to pupils from the non-grant-aided secondary schools. Deficiency in self-control ability and response inhibition ability among pupils in the non-grant-aided secondary schools could be a contributing factor to lower academic performance among pupils in the non-grant-aided secondary schools. If we are to provide inclusive and quality education to all pupils, there is arguably a need for deliberate and explicit teaching of executive function skills to pupils, both in grant-aided secondary schools and non-grant-aided secondary schools.

Keys Words: academic performance disparity, executive function skills, flexible thinking, grant-aided school, metacognition, non-grant-aided school, organisation ability, planning ability, response inhibition, self-control ability, task initiation ability, working memory

INTRODUCTION

Disparity in academic performance between pupils in grant-aided secondary schools and pupils in non-grant-aided secondary schools has been a source of concern among educators (Ministry of Education, Science, Vocational Training and Early Education, 2014). In the Zambian education system, there are three major types of schools: grant-aided schools, public schools (also known as government schools), and private schools. Grant-aided schools are schools established and owned by a private individual, a group of people or an organisation (usually a religious organisation) which receive financial, material and technical assistance from government (Education Act, 2011). Generally speaking, grant-aided schools distinguish themselves from other types of school by blending the national education curriculum with explicit values education (Ministry of Education, 2023). Public schools (also known as government schools) are schools that are wholly owned by government and are managed using public funds. Private schools are schools established and owned by private individuals, a group of people or an organisation and are distinguished from grant-aided schools by the fact

that they do not receive financial support from government but entirely depend on fees from learners (Education Act, 2011). In this paper, the two grant-aided schools referred to are both established and owned by the Catholic Church and receive financial, material and technical assistance from the government of the republic of Zambia, while the two non-grant-aided schools are both owned and controlled by the government of the republic of Zambia and are managed using public funds. It has been observed that pupils in grant-aided secondary schools consistently outshine their counterparts in non-grant-aided secondary schools (MoESVTEE, 2014). In Kabwe town in central province in Zambia, for example, pupils in grant-aided secondary schools have consistently been recording quality pass rate scores above the district standard mean pass rate of 75% both at junior secondary school leaving examination and school certificate examination level, while 95% of pupils in non-grant-aided secondary schools have been recording quality pass rate scores below the district standard mean pass rate of 75%.

Malambo (2013), in a qualitative case study conducted in two schools, a grant-aided and a non-grant-aided secondary school in western province in Zambia, explored factors that affect academic learner performance in grant-aided and non-grant-aided secondary schools. The findings reaffirmed the existence of an academic performance gap between pupils in the grant-aided secondary school and pupils in the non-grant-aided secondary school. Malambo attributed this observed academic performance difference to the fact that the grant-aided school was better equipped with teaching and learning materials, and had controlled pupil enrolment compared to the non-grant-aided secondary school (Malambo, 2013). Malambo also noted that workforce and pupils in the grant-aided secondary school were better motivated and disciplined compared to their counterparts in the non-grant-aided secondary school. In addition, Malambo observed that the grant-aided secondary school had better developed continuing professional development (CPD) activities, coupled with stronger academic policies and teacher-monitoring systems, as compared to the non-grant-aided secondary school (Malambo, 2013). Maluma and Banja (2019), also investigated factors that affected learner academic performance at school certificate examination level focusing on higher-performing grant-aided secondary schools and lower-performing grant-aided secondary schools. Four secondary schools in southern province of Zambia were selected where two were higher-performing grant-aided secondary schools and the other two were lower-performing grant-aided secondary schools in the period of five years from 2011 to 2015. The findings attributed the academic performance disparity between the higher-performing grant-aided secondary schools and the lower-performing grant-aided secondary schools to differences in the competency level and the administrative skills of school administrators coupled with differences in the quality of the physical learning environment (Maluma & Banja, 2019). Taking a step further, Cajila (2020) investigated the cause of the disparity in literacy levels between pupils in grant-aided and non-grant-aided lower-primary schools. Unlike grant-aided lower-primary schools, non-grant-aided lower-primary schools had relatively few teachers and text books while having a larger population of pupils. Cajila further noted that the non-grant-aided lower-primary schools had fewer teacher–pupil contact hours compared to the grant-aided lower-primary schools (Cajila, 2020).

Malambo (2013), Maluma and Banja (2019) and Cajila (2020) all seem to agree that the low academic performance of pupils in the non-grant-aided schools compared to pupils in the grant-aided schools is due to the exclusion, in part or in whole, of fundamental components that constitute quality education, such as the quality of the physical and social learning environment, the quality of teacher subject knowledge, the quality of teacher knowledge of learning and teaching processes, and the quality of curriculum outcomes (United Nations Children's Fund, 2000). However, it is worth noting that the researchers mentioned limited their studies to external factors that are outside the control of individual pupils. All the factors that they cited to occasion academic performance disparity between pupils in grant-aided and non-grant-aided schools were outside the control of individual pupils. In a way, this reduced pupils to being mere spectators in their learning process. On the other hand, studies in neuropsychology have demonstrated that, aside from such external factors, the brain-based abilities of each individual pupil also have a bearing on academic performance. These cognitive abilities are referred to as executive function skills. Miller and Cohen (2001) define executive function skills as cognitive abilities that control and coordinate information in the service of goal-directed actions. Laura and Kristin (2013) also describe executive function skills as brain-based abilities that help pupils connect past knowledge to present knowledge. From the classroom practice point of view, Zelazo, Blair and Willoughby (2016) define executive function skills as a set of cognitive skills that help pupils to, intentionally and

knowingly, regulate and adapt their behaviour. They further argue that executive function skills enable pupils to focus on any given task such as assignments, class exercises and homework; and also enable pupils to retain and work with information on their minds without being distracted (Zelazo, Blair & Willoughby, 2016). Different scholars have identified different types of executive function skills (Dawson & Guare, 2010). This paper, however, has limited itself to eight of them. These are: working memory ability, task initiation ability, self-control ability, response inhibition ability, planning ability, organisation ability, metacognition ability and flexible thinking ability. According to Dawson and Guare (2010), working memory ability is the capacity of a pupil to hold information in mind while performing other activities, and task initiation ability is defined as the ability of the pupil to begin a task or assignment without undue procrastination. Self-control ability is defined as the capacity to manage emotions in order to achieve goals, complete tasks, or control and direct behaviour, while planning ability is defined as the capacity to create a roadmap before undertaking any given task. This roadmap acts as the compass in the execution of any task. Dawson and Guare also conceptualise organisation ability as the capacity to create and maintain systems, and to keep track of information or materials, while metacognition ability is defined as the ability to stand back and take a bird's-eye view of oneself in any situation. Response inhibition ability is defined as the ability to think through any given task or situation before acting. Flexible thinking ability is defined as the ability of the pupil to revise plans in the face of obstacles, setbacks, new information or mistakes (Dawson & Guare, 2010). These abilities have been reported to play a fundamental role in the academic performance of pupils. Studies suggest that a deficiency in any one of these abilities results in poor academic performance in pupils. On the other hand, pupils with well-developed executive function skills have been observed to perform better in all academic tasks. Some particular examples that have been adduced where executive function skills have a direct bearing on pupils include composition writing, comprehension and mathematics. Hughes, Ruhl, Schumaker and Deshler (2002) noted that when it comes to quality composition writing, a pupil needs to plan, organise and prioritise ideas and information. Furthermore, he or she needs to revise and edit his or her own work. Quality composition writing therefore demands that a pupil uses effectively the planning ability, the ability to organise, metacognition ability and flexible thinking ability. A weakness in any of these abilities can therefore result in a pupil finding it difficult to write quality compositions. With regards to comprehension, which is also referred to as 'reading to understand', Feifer and DeFina (2002) noted that a pupil needs to coordinate several executive function skills if he or she is to be successful in accomplishing a task. They argue that, when reading to understand, a pupil must keep already known words in his or her mind and subsequently integrate them with new words, the meaning of which he or she has decoded, before finally evaluating his or her own work (Feifer & DeFina, 2002). The process of 'reading to understand', therefore, requires that a pupil integrate working memory ability, planning ability, organisation ability, metacognition ability and flexible thinking ability. Deficiency in one or more of these cognitive abilities, all of which are fundamental to comprehension, can result in a pupil having challenges with comprehension. According to LeFevre and Bisanz (2012), success in mathematics demands that a pupil possess a well-developed working memory and inhibition abilities. Solving mathematical problems demands that a pupil be able to remember mathematical formulae. Furthermore, if a pupil is to successfully handle mathematics, he or she must be able to remember several procedural steps while keeping other necessary information in mind. It can therefore be said that working memory, task initiation, self-control, response inhibition, planning, organisation, metacognition and flexible thinking abilities all play a fundamental role in the academic achievement of pupils. This study explores the distribution of these eight cognitive abilities among selected grade eleven pupils from two grant-aided secondary schools and two non-grant-aided secondary schools in Kabwe town in central province in Zambia

Research Study Design

A quantitative survey research design strategy (Bryman, 2012) was used to investigate the distribution of eight executive function skills, namely: working memory, task initiation, self-control, response inhibition, planning, organisation, metacognition and flexible thinking abilities among selected grade eleven pupils in grant-aided and non-grant-aided secondary schools.

Research Site

The study was carried out in Kabwe town in central province in Zambia. Two grant-aided secondary schools, namely SSGTA and SSCC, and two non-grant-aided secondary schools, namely SSWB and SSKR, all located

in Kabwe town, were selected. SSGTA, a grant-aided secondary school, is in the same location as SSKR, a non-grant-aided secondary school, while SSCC, a grant-aided secondary school, is in the same area as SSWB, a non-grant-aided secondary school. The names used for the schools that participated in the study are not their real names but pseudonyms.

Population, Sample and Sampling Technique

A total number of 115 grade eleven pupils participated in the study. This composite sample consisted of 52 pupils from the two grant-aided secondary schools and 63 pupils from the two non-grant-aided secondary schools. Selection of participants was done using a convenience sampling strategy (Bryman, 2012). Participants were recruited on a voluntary basis. Scholars have noted that executive function skills are not static: they start to develop from early infancy up until around the mid-twenties (Saradha & Thangarajathi, 2017). Therefore, in order to control for possible age-related differences in pupils' executive function skills, only grade eleven pupils from both the grant-aided and non-grant-aided secondary schools participated in the study.

Ethical Considerations

Permission to conduct the study was obtained from the relevant authorities while participants were informed of their right to withdraw from the study at any point they might wish to do so. Furthermore, participants were assured of the protection of their identities.

Research Objective

The main objective of the research was to establish whether there was a significant statistical difference in the strength of working memory ability, task initiation ability, self-control ability, response inhibition ability, planning ability, organisation ability, metacognition ability and flexible thinking ability between selected grade eleven pupils in two grant-aided and two non-grant-aided secondary schools in Kabwe town in central province in Zambia.

Research Question

Is there a significant statistical difference in the strength of working memory ability, task initiation ability, self-control ability, response inhibition ability, planning ability, organisation ability, metacognition ability and flexible thinking ability between selected grade eleven pupils in the two grant-aided and two non-grant-aided secondary schools?

Null Hypothesis (H₀)

There was not a significant statistical difference in the strength of working memory ability, task initiation ability, self-control ability, response inhibition ability, planning ability, organisation ability, metacognition ability and flexible thinking ability between the selected 52 grade eleven pupils from grant-aided secondary schools and the selected 62 grade eleven pupils from non-grant-aided secondary schools.

Research Instruments

We used a self-administered executive function skills inventory (Dawson & Guare, 2010) to collect data. This is a seven-point self-administered behavioural rating Likert scale used to assess the strength of pupils' executive function skills. The questionnaire had a total of twenty-four items where each of the eight executive function skills was described with three questionnaire items. The participants were asked to rate their responses to the items in the questionnaire on a seven-point Likert scale (strongly disagree = 1, disagree = 2, tend to disagree = 3, neutral = 4, tend to agree = 5, agree = 6, strongly agree = 7). To assess the strength of the working memory, for example, a participant had to rate on the seven-point scale the degree to which the following statements described him or her:

- I have a good memory for facts, dates, and details

- I am very good at remembering the things I have committed to do
- I rarely need reminders to complete tasks

To determine the score on working memory ability, the three individual scores were added up. The sum of the three individual scores indicated the strength of that particular executive function skill. A lower score indicated a weaker executive function skill whereas a higher score indicated a stronger executive function skill. The highest possible score on each executive function skill was twenty one while the lowest possible score was three. The tool was adopted for its ability to measure the strength of executive function skills in a real-world context. The tool was also easily accessible and affordable.

RESULTS

Using a statistical package for social sciences (SPSS) software, an independent sample t – test was carried out. This section presents the findings on the distribution of working memory ability, task initiation ability, self-control ability, response inhibition ability, planning ability, organisation ability, metacognition ability and flexible thinking ability among the selected grade eleven pupils ($n = 52$) in grant-aided secondary schools (SSGTA and SSCC) and the selected grade eleven pupils ($n = 63$) in non-grant-aided secondary schools (SSWB and SSKR).

There was not a significant statistical difference in the self-reported strength in working memory ability ($t(113) = .85, p = .40$), metacognition ability ($t(113) = .44, p = .66$) and organisation ability ($t(113) = .16, p = .86$) between the selected grade eleven pupils from the grant-aided and non-grant-aided secondary schools. Furthermore, there was not a significant statistical difference in the self-reported strength in planning ability ($t(113) = -.87, p = .38$), task initiation ability ($t(113) = 1.01, p = .311$) and flexibility thinking ability ($t(113) = -.59, p = .56$) between the selected grade eleven pupils from the grant-aided secondary and non-grant-aided secondary schools. Table 1 presents independent sample t-test results for working memory, organization, metacognition, planning, task initiation, and mental flexibility ability between pupils in the grant-aided and non-grant-aided secondary schools.

Table 1: Independent sample t-test for working memory, organization, metacognition, planning, task initiation, and mental flexibility ability between pupils in the grant-aided and non-grant-aided secondary schools

<i>Variable</i>	<i>Type of School</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>df</i>	<i>t- Value</i>	<i>t – Value</i>
Working Memory	Grant- aided	53	11.62	4.83	113	.85	.40
	Non-Grant- aided	62	10.86	4.75			
Organisation	Grant- aided	53	8.81	4.66	113	.16	.86
	Non-Grant- aided	62	8.63	5.31			
Metacognition	Grant- aided	53	10.65	5.15	113	.44	.66
	Non-Grant- aided	62	10.23	5.22			
Planning	Grant- aided	53	11.65	4.59	113	-.87	.38
	Non-Grant- aided	62	12.41	4.77			
Task initiation	Grant- aided	53	10.17	5.03	113	1.01	.31
	Non-Grant- aided	62	9.30	4.17			

Mental flexibility	Grant- aided	53	9.96	3.94	113	-.59	.56
	Non-Grant- aided	62	10.40	3.96			

However, there was a significant statistical difference in the self-reported strength in self-control ability ($t(113) = 1.96, p = .05$) and response inhibition ability ($t(113) = 2.89, p = .005$) between the selected grade eleven pupils from the grant-aided and non-grant-aided secondary schools. Self-control and response inhibition were reported to be stronger among pupils from the grant-aided secondary schools compared to pupils from the non-grant-aided secondary schools. Table 2 presents independent sample t-test results for self-control ability and response inhibition ability between pupils in the grant-aided and non-grant-aided secondary schools.

Table 2: Independent sample t-test for self-control and response inhibition abilities across pupils in grant-aided and non-grant-aided secondary schools

Variable	Type of School	N	Mean	SD	df	t- Value	p - Value
Self-control	Grant-aided	53	14.81	3.90	113	1.96	.05
	Non-Grant-aided	62	13.25	4.48			
Response inhibition	Grant-aided	53	10.73	4.29	113	2.89	.005
	Non-Grant-aided	62	8.51	3.95			

DISCUSSION

The current study investigated the distribution of eight executive function skills among grade eleven pupils from grant-aided and non-grant-aided secondary schools. The eight executive function skills were working memory ability, self-control ability, response inhibition ability, planning ability, organisation ability, metacognition ability, initiation ability, and flexible thinking ability. The working hypothesis was that there was not a statistical difference in the strength of the eight executive function skills between grade eleven pupils in the grant-aided secondary schools and grade eleven pupils in the non-grant-aided secondary schools. According to the findings, the hypothesis was sustained on working memory ability, task initiation ability, planning ability, organisation ability, metacognition ability, and flexible thinking ability: pupils in the grant-aided secondary schools and non-grant-aided secondary schools reported a similar degree of strength in these executive function skills. The hypothesis, however, was not sustained in respect of two executive function skills, namely self-control ability and response inhibition ability. Pupils from the grant-aided secondary schools reported stronger self-control and response inhibition abilities while pupils in the non-grant-aided secondary schools reported weaker self-control ability and response inhibition ability.

Self-control is associated with positive academic performance (Baumeister, 2002). According to Baumeister, self-control is the action a pupil takes to, intentionally and knowingly, alter his or her own behaviour and orient it in line with the curriculum and teachers' expectations (Baumeister, 2002). In daily classroom practice, pupils are expected to demonstrate a specific level of knowledge, mastery of skills and a change in attitude. Pupils with self-reported stronger self-control ability have a greater chance of controlling their own behaviour and orienting it in line with daily expected learning outcomes as compared to pupils with self-reported weaker self-control. Duckworth, Taxer, Eskreis-Winkler, Galla and Gross (2019) agree with the observation that self-control helps a pupil take ownership and full control of all his or her present thoughts, feelings, and actions while focusing on long lasting knowledge, skills and values. Self-reported weaker self-control suggests a possible struggle among pupils in the non-grant-aided secondary schools with self-regulation in thoughts, feelings, and actions. When faced with the dilemma of choosing between playing soccer and preparing for an examination, for example, they may be more likely to go out to play soccer than to remain indoors and prepare.

Response inhibition, also known as impulse control, is the ability pupils exercise whenever they think through an action before doing it (Dawson & Guare, 2010). This ability helps pupils control impulse in the face of distractions, especially when handling challenging tasks (Dvorak, 2024). According to Laura and Kristin (2013), pupils with weaker response inhibition ability can be overly quick act and are likely to rush through their class exercises, homework and examinations. In so doing, they are sacrificing accuracy and completeness for speed. Therefore, pupils from the non-grant-aided secondary schools with self-reported weaker response inhibition ability are more likely to make impaired decisions and rush through work compared to pupils from the grant-aided secondary schools with self-reported stronger response inhibition ability.

CONCLUSION AND RECOMMENDATIONS

It is important to note that the degree of the strength of executive function skills varies from pupil to pupil, and from one group of pupils to another. Findings from this study, therefore, may not apply to all the pupils in all grant-aided and non-grant-aided secondary schools. The results are particular and unique to the sample of pupils that participated in the study. The current study, however, may be significant in the on-going quest to eliminate the existing disparity in academic performance between pupils in grant-aided and non-grant-aided secondary schools. The findings suggest the need for educators to pay attention to the executive function skills of all the pupils in their classrooms. The findings also indicate that, aside the commonly known external factors that cause poor performance in schools, weakness in executive function skills may be a contributing factor to academic disparity between pupils in grant-aided and non-grant-aid secondary schools. It would therefore be beneficial to conduct further investigations into the distribution of executive function skills among pupils, and to explore strategies to support pupils who experience challenges in this area.

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