

**A COMPARISON OF THE ACHIEVEMENT GOAL  
ORIENTATION OF MATHEMATICS LEARNERS  
WITH/WITHOUT ATTENTION DEFICIT HYPERACTIVITY  
DISORDER (ADHD)**

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*This paper reports on the achievement goal orientation of Grades 8-9 mathematics learners with/without ADHD in the Ekurhuleni-East District in South Africa. The research question is: How does the achievement goal orientation of learners suffering from ADHD and those without ADHD compare? A social constructivism paradigm with a quantitative design was adopted. Ten learners suffering from ADHD and 10 learners without ADHD completed structured questionnaires. The results revealed that non-ADHD learners perceived peers' mastery goals orientation and behavioral and cognitive engagement significantly higher; while ADHD learners regarded personal performance avoid goals orientation, perception of parents' mastery emphasis and their perception of parents' performance emphasis significantly higher.*

**FOCUS**

The purpose of this paper is to compare the achievement goal orientation of Grades 8-9 mathematics learners suffering from attention deficit hyperactivity disorder (ADHD) with those learners not suffering from ADHD in a school in Ekurhuleni-East. Achievement goal orientation is based on a modern 'goal-as-motives' theory suggesting that 'all actions are given meaning, direction and purpose by the goals that individuals seek out, and that the quality and intensity of behaviour will change as these goals change' (Covington, 2000, p. 174). By reinforcing particular goals and disregarding others, a teacher can influence and ultimately change the way in which learners learn and thus change their motivation (Covington, 2000), which could lead to better performance in mathematics. Consequently, the question is: What is the achievement goal orientation of learners suffering from ADHD and those not suffering from ADHD?

## **THEORETICAL FRAMEWORK AND LITERATURE OVERVIEW**

Learners' goals influence their learning activities, engagement in tasks, attitude towards learning and consequently their achievement. According to Vedder-Weiss and Fortus (2011, p.200) the adoption of different goal orientations lead to differences in the way learners engage with school work and their consequent emotional experiences at school.

DuPaul, Volpe, Jitendra, Lutz, Lorah and Gruber (2004) examined different factors, including behavioural observations that determine academic achievement in the ADHD learners. In particular, the strongest factor for academic achievement found was teachers' perceptions of academic skills. Thus, interventions should not only include the use of medications, but also be combined with academic support.

According to Zentall (1990) Intelligence Quota (IQ) and reading comprehension skills showed no indications concerning ADHD learners' mathematical skills. However, calculation speed and task behaviour had significant importance pertaining to their performance and goal achievement. On the contrary, Lamminmaeki, Ahonen, Naerhi, Lyytinem and Todd de Barra (1995) found that learners with ADHD were no more impaired in mathematics than others without ADHD.

Zentall, Smith, Lee and Wieczorek (1994) discovered that the ADHD boys all showed a lower problem-solving ability. The poor performance and achievement goal orientation was accredited to the various subtypes of ADHD found typically as a behavioural symptom: distractibility, hyperactivity and impulsivity. Zentall et al. (1994) believed that when an ADHD child is distracted, the child is attempting to lessen their under-stimulated minds by seeking task or reactions that would increase the levels of stimulation. Thus, by using external stimulating factors during a boring but routine task, the child with ADHD will perform better.

Given the limited information and research on mathematical understanding and calculations within ADHD learners, very few conclusions can be made. However, it has been shown that children with ADHD are slower and less accurate when conducting calculations than those non-ADHD children. Thus, there is conjecture that the over-working of memory causes the need to solve and calculate which then causes the deficit in the achievement goal orientation and performance. Moreover, the poor achievement goal orientations in calculations and solving in mathematics may be associated with hyperactivity and distractibility, two major indicators of ADHD.

Much research (Ackerman, Dyckman & Oglesby, 1983; Zentall, 1990; Zentall & Ferkis, 1993; Zentall, Smith, Lee & Wiczorek, 1994; Lamminmaeki, Ahonen, Naerhi, Lyytinen & Todd de Barra, 1995; Marshall, Hynd, Handwerk & Hall, 1997) has been dedicated to the negative impact of ADHD on school performance. However, most research on academic success and ADHD has focussed on reading disorders in children with ADHD rather than difficulties in mathematics (Lucangeli & Cabrele, 2006, p.53).

August and Garfinkel (1990) examined the reading ability of ADHD boys', diagnosed in a university outpatient clinic, against the reading ability of non-ADHD boys. Barry, Lyman and Klinger (2002) focussed on the negative consequences that ADHD has on an individual's academic achievements due to behaviour and argued that:

children with ADHD experience shortfalls in some of the abilities establishing the executive functions such as planning, organising, maintaining an appropriate problem-solving set to achieve a future goal, inhibiting an inappropriate response or deferring a response to a more appropriate time representing a task mentally (i.e. in working memory), cognitive flexibility and deduction based on limited information. (p.274)

A study that identifies the achievement goal orientation of Grades 8-9 mathematics learners suffering from ADHD in relationship to those learners not suffering from ADHD is new to South Africa, even though there have been investigations into the types of goals learners assume in the classroom and the contextual factors which play a role in learners' choices of goals and learning activities (Tapola & Niemivirta, 2008; Vedder-Weiss & Fortus, 2011). In particular, Vedder-Weiss and Fortus (2011) referred to a wide range of motivation research and conclude that declines in motivation and attitude toward learning have been common across learning areas and are often linked to changes in classroom environment.

## **RESEARCH METHODOLOGY**

### **Research design**

Vandeyar (2010, p.87) noted that social investigations are bound in the 'consideration of how certain phenomena or forms of knowledge are achieved by people in action', which convinced me to adopt a social constructivism theoretical paradigm. Moreover, this paradigm is tailored to an investigation of how learners, parents and teachers perceive achievement goal orientation of the school and classroom environment and the way in which these perceptions inform and shape their choice of a specific goal orientation.

I utilised a quantitative technique in the study (Creswell & Clark, 2006). I established learners' perceptions regarding achievement goal orientation quantitatively through questionnaires. In order to compare the achievement goal orientation of learners suffering with ADHD and those not suffering from ADHD, the following hypothesis was interrogated in the quantitative approach:

There are significant differences in the achievement goal orientation of learners suffering from ADHD and those not suffering from ADHD.

## **Sample**

A purposeful sampling technique (Creswell, 2003) was used to select grades 8-9 mathematics learners suffering from ADHD and those not suffering from ADHD from one secondary school in a single district in South Africa, namely the Ekurhuleni-East District. Criterion sampling was utilised (Palys, 2008). The area was chosen for I had easy access to the school and the participants were selected via postings in the school's weekly newsletter, through private discussions with the school counsellor and through parent evening discussions with the parents of those learners, suffering from ADHD. Participation was voluntary, consent was obtained and the anonymity of the participants was protected (Mouton, 2001). From a population of 540 grades 8-9 learners in the school, 10 non-ADHD learners and 10 ADHD learners participated voluntarily. Sixteen of the 20 learners were in one class. Furthermore, all the learners in the study were proficient in reading, speaking and writing in English. Moreover, I could only utilise a natural formed group, namely learners in a classroom setup for this research, which justifies a convenience sample (Creswell, 2003). Participants in the ADHD sample were required to have a diagnosis of ADHD from a physician or psychologist, but no diagnosis of a neurological disorder or genetic syndrome, for example pervasive developmental disorders, psychotic disorders or Tourette's disorder. Also, the learners without ADHD were required not to have any previous diagnosis of ADHD or any learning or behaviour problems identified by parents. Seven of the learners suffering from ADHD, were taking psycho-stimulant medication for their symptoms, for example Ritalin or Concerta. However, on the data gathering date, participants were asked to be medication-free. Eight learners suffering from ADHD were receiving some form of special education service, including support from an educational tutor.

## **Data collection: Questionnaires**

The quantitative feature was a structured questionnaire based on an existing standardised instrument. Permission was obtained to utilise and amend a questionnaire for mathematics, developed by Veder-Weiss and Fortus (2011) for a similar study in Israel comparing grades five to eight learners' goal orientations in science learning. The questionnaire consisted of 89 mixed survey items with a 1-5 point Likert scale (1 = Not true at all and 5 = Very true) relating to 17 motivation

constructs. The questionnaires were completed in test conditions and took approximately one hour.

The reasons for using the questionnaire were firstly, the questionnaire was standardised, so it allowed minimal misinterpretation to occur concerning the information presented to them. This particular issue was solved by piloting the questions. The pilot group consisted of two individuals, whom were not participating in the final research project.

One individual was clinically diagnosed with ADHD and the second individual was non-ADHD. Secondly, using a questionnaire is relatively a quick way to collect information.

### **Data analyses**

The results for each question in the questionnaire were calculated and categorised into 17 key motivation constructs. Thereafter, the Mann-Whitney U Test, as appropriate non-parametric statistical technique, was undertaken to examine differences between the medians of the responses of non-ADHD learners and ADHD learners on the 17 key motivation constructs respectively.

## Reliability

The internal consistency of each of the of the 17 key motivation constructs was determined by using the Cronbach  $\alpha$  coefficient as presented in Table 1. A score of 0.7 and higher was assumed as reliable.

| <b>Construct</b>  | <b>No. of items</b> | <b>Cronbach <math>\alpha</math></b> |
|---|---------------------|-------------------------------------|
| Learners' perception of teacher's mastery goals emphasis              | 8                   | 0.683                               |
| Learners' perception of teacher's performance approach goals emphasis | 4                   | 0.746                               |
| Learners' perception of teacher's performance avoid goals emphasis    | 4                   | 0.701                               |
| Learners' perception of school's mastery goals emphasis               | 5                   | 0.694                               |
| Learners' perception of school's performance goals emphasis           | 5                   | 0.722                               |
| Learners' personal mastery goals orientation                          | 7                   | 0.715                               |
| Learners' personal performance approach goals orientation             | 5                   | 0.675                               |
| Learners' personal performance avoid goals orientation                | 5                   | 0.677                               |
| Learners' self-efficacy   | 5                   | 0.716                               |
| Learners' perception of peers' mastery goals orientation              | 4                   | 0.709                               |
| Learners' perception of peers' performance approach goals orientation | 4                   | 0.693                               |
| Learners' perception of peers' performance avoid goals orientation    | 4                   | 0.678                               |
| Learners' perception of parents' mastery emphasis                     | 5                   | 0.717                               |
| Learners' perception of parents' performance emphasis                 | 4                   | 0.727                               |
| Behavioral and cognitive engagement                                   | 5                   | 0.716                               |
| Active extra-curricular engagement                                    | 7                   | 0.763                               |
| Active extra-curricular rejection                                     | 6                   | 0.761                               |

Table 1: Internal reliability of the of the motivation constructs.

## Validity

Veder-Weiss and Fortus (2011) granted permission for the amendment and usage of their questionnaire on goal orientations in science learning and the intellectual property rights of it were recognised. The questionnaire had already complied with all validity aspects. To ensure face and content validity, the questionnaire was shown to colleagues for comments and inputs, to ensure that the constructs were clearly conceptualised. Consequently, the questionnaires were amended with regard to timeframes, terminology, readability and clarity. The purpose was to ensure coherency and consistency of the questions. The questionnaires were administered under examination conditions. All the participants' contributions, including literature, were recognised by proper referencing.

## MAIN FINDINGS

### Findings from questionnaires

The Mann-Whitney U Test was undertaken to examine differences between the medians of the responses of non-ADHD learners and ADHD learners on the 17 key motivation constructs respectively. Table 2 presents data on the calculated  $z$ -values and the approximately calculated statistical significance of differences between the crossed variables. A correlation at the 0.05 level was assumed as significant.

| Constructs  | Mann-Whitney U | Wilcoxon W | Z      | Asymp. Sig. (2-tailed) | Exact Sig. (2-tailed) | Exact Sig. (1-tailed) |
|---|----------------|------------|--------|------------------------|-----------------------|-----------------------|
| Learners' perception of teacher's mastery goals emphasis              | 34.000         | 89.000     | -1.218 | .223                   | .247                  | .124                  |
| Learners' perception of teacher's performance approach goals emphasis | 30.500         | 85.500     | -1.492 | .136                   | .143                  | .072                  |
| Learners' perception of teacher's performance avoid goals emphasis    | 46.000         | 101.000    | -.303  | .762                   | .796                  | .400                  |
| Learners' perception of school's mastery goals emphasis               | 47.000         | 102.000    | -.229  | .819                   | .853                  | .427                  |
| Learners' perception of school's performance goals emphasis           | 47.000         | 102.000    | -.229  | .819                   | .853                  | .427                  |

|   |        |         |        |       |       |      |
|---|--------|---------|--------|-------|-------|------|
| Learners' personal mastery goals orientation                          | 32.500 | 87.500  | -1.334 | .182  | .190  | .100 |
| Learners' personal performance approach goals orientation             | 40.000 | 95.000  | -.760  | .447  | .481  | .024 |
| Learners' personal performance avoid goals orientation                | 21.000 | 76.000  | -2.209 | .027* | .029* | .015 |
| Learners' self-efficacy   | 43.500 | 98.500  | -.498  | .619  | .631  | .316 |
| Learners' perception of peers' mastery goals orientation              | 22.500 | 77.500  | -2.127 | .033* | .035* | .018 |
| Learners' perception of peers' performance approach goals orientation | 34.000 | 89.000  | -1.220 | .222  | .247  | .124 |
| Learners' perception of peers' performance avoid goals orientation    | 28.500 | 83.500  | -1.645 | .100  | .105  | .053 |
| Learners' perception of parents' mastery emphasis                     | 17.500 | 72.500  | -2.533 | .011* | .11*  | .056 |
| Learners' perception of parents' performance emphasis                 | 13.000 | 68.000  | -2.824 | .005* | .004* | .001 |
| Behavioral and cognitive engagement                                   | 12.500 | 67.500  | -2.866 | .004* | .003* | .001 |
| Active extra-curricular engagement                                    | 48.500 | 103.500 | -.114  | .909  | .912  | .456 |
| Active extra-curricular rejection                                     | 42.000 | 97.000  | -.607  | .544  | .579  | .290 |

\*Correlation is significant at the 95% level

Table 2: Test statistics of learners without/with ADHD and the motivation constructs.



Learners with/without ADHD differed significantly at a 95% level in terms of five of the 17 motivation constructs mentioned by Veder-Weiss and Fortus (2011), namely learners' personal performance avoid goals orientation ( $p = .027 < .05$ ); learners' perception of peers' mastery goals orientation ( $p = 0.033 < 0.05$ ); learners' perception of parents' mastery emphasis ( $p = .011 < .05$ ); learners' perception of parents' performance emphasis ( $p = .005 < .05$ ); and behavioural and cognitive engagement ( $p = .004 < .05$ ).

As there were statistical significant differences between crossed variables, there was a need to analyse the data shown in table 3, indicating which continuous variable was higher on average.

| <b>Construct</b>  | <b>Independent variables</b> | <b>N</b> | <b>Mean Rank</b> | <b>Sum of Ranks</b> |
|---|------------------------------|----------|------------------|---------------------|
| Learners' perception of teacher's mastery goals emphasis              | Non-ADHD                     | 10       | 12.10            | 121.00              |
|   | ADHD                         | 10       | 8.90             | 89.00               |
| Learners' perception of teacher's performance approach goals emphasis | Non-ADHD                     | 10       | 8.55             | 85.50               |
|   | ADHD                         | 10       | 12.45            | 124.50              |
| Learners' perception of teacher's performance avoid goals emphasis    | Non-ADHD                     | 10       | 10.90            | 109.00              |
|   | ADHD                         | 10       | 10.10            | 101.00              |
| Learners' perception of school's mastery goals emphasis               | Non-ADHD                     | 10       | 10.20            | 102.00              |
|   | ADHD                         | 10       | 10.80            | 108.00              |
| Learners' perception of school's performance goals emphasis           | Non-ADHD                     | 10       | 10.20            | 102.00              |
|   | ADHD                         | 10       | 10.80            | 108.00              |
| Learners' personal mastery goals orientation                          | Non-ADHD                     | 10       | 12.25            | 122.50              |
|   | ADHD                         | 10       | 8.75             | 87.50               |
| Learners' personal performance approach goals orientation             | Non-ADHD                     | 10       | 9.50             | 95.00               |
|   | ADHD                         | 10       | 11.50            | 115.00              |
| Learners' personal performance avoid goals orientation                | Non-ADHD                     | 10       | 7.60             | 76.00               |
|   | ADHD                         | 10       | 13.40            | 134.00              |
| Learners' self-efficacy   | Non-ADHD                     | 10       | 11.15            | 111.50              |
|   | ADHD                         | 10       | 9.85             | 98.50               |
| Learners' perception of peers' mastery goals orientation              | Non-ADHD                     | 10       | 13.25            | 132.50              |
|   | ADHD                         | 10       | 7.75             | 77.50               |

|   |          |    |       |        |
|---|----------|----|-------|--------|
| Learners' perception of peers' performance approach goals orientation | Non-ADHD | 10 | 8.90  | 89.00  |
|   | ADHD     | 10 | 12.10 | 121.00 |
| Learners' perception of peers' performance avoid goals orientation    | Non-ADHD | 10 | 8.35  | 83.50  |
|   | ADHD     | 10 | 12.65 | 126.50 |
| Learners' perception of parents' mastery emphasis                     | Non-ADHD | 10 | 13.75 | 137.50 |
|   | ADHD     | 10 | 7.25  | 72.50  |
| Learners' perception of parents' performance emphasis                 | Non-ADHD | 10 | 6.80  | 68.00  |
|   | ADHD     | 10 | 14.20 | 142.00 |
| Behavioral and cognitive engagement                                   | Non-ADHD | 10 | 14.25 | 142.50 |
|   | ADHD     | 10 | 6.75  | 67.50  |
| Active extra-curricular engagement                                    | Non-ADHD | 10 | 10.65 | 106.50 |
|   | ADHD     | 10 | 10.35 | 103.50 |
| Active extra-curricular rejection                                     | Non-ADHD | 10 | 9.70  | 97.00  |
|   | ADHD     | 10 | 11.30 | 113.00 |

Table 3: Motivation constructs of non-ADHD learners and ADHD learners.

From this data, it can be concluded that, non-ADHD learners regarded their goal orientation significantly higher than ADHD learners, pertaining to:

- Learners' perception of peers' mastery goals orientation (non-ADHD  $Mdn = 5$  vs. ADHD  $Mdn = 4$ ),  $U = 34.0$ ,  $p = .033 < .05$  (at the 95% level of confidence),  $r = .27$  (a finding with a low to moderate practical significance);
- Behavioral and cognitive engagement (non-ADHD  $Mdn = 5$  vs. ADHD  $Mdn = 4$ ),  $U = 12.5$ ,  $p = .004 < .05$  (at the 95% level of confidence),  $r = .03$  (a finding with a low practical significance);

In contrast, ADHD learners regarded their goal orientation significantly higher than non-ADHD learners, pertaining to:

- Learners' personal performance avoid goals orientation (non-ADHD  $Mdn = 3$  vs. ADHD  $Mdn = 4$ ),  $U = 21.0$ ,  $p = .027 < .05$  (at the 95% level of confidence),  $r = .49$  (a finding with moderate to high practical significance);
- Learners' perception of parents' mastery emphasis (non-ADHD  $Mdn = 5$  vs. ADHD  $Mdn = 4$ ),  $U = 17.5$ ,  $p = .011 < .05$  (at the 95% level of confidence),  $r = .57$  (a finding with moderate to high practical significance);
- Learners' perception of parents' performance emphasis (non-ADHD  $Mdn = 4$ , vs. ADHD  $Mdn = 5$ ),  $U = 13.0$ ,  $p = .005 < .05$  (at the 95% level of confidence),  $r = .63$  (a finding with moderate to high practical significance);

The above-mentioned findings supported the hypothesis about the comparisons between five key motivation constructs and the non-ADHD and ADHD learners.

### **Discussion and conclusion**

The paper focused on comparing the achievement goal orientation of Grades 8-9 mathematics learners suffering from attention deficit hyperactivity disorder (ADHD) with those learners not suffering from ADHD in a school in Ekurhuleni-East.

The results from the quantitative data address the research question, namely that non-ADHD learners regarded their goal orientation significantly higher than ADHD learners, pertaining to their perception of peers' mastery goals orientation and behavioural and cognitive engagement. On the other hand, ADHD learners regarded their goal orientation significantly higher than non-ADHD learners, pertaining to their personal performance avoid goals orientation, perception of parents' mastery emphasis and their perception of parents' performance emphasis. Thus, ADHD learners, like the parents, as noted by Vedder-Weiss and Fortus (2013) perceive goals that parents emphasise better predictors of their motivation, than perceptions of the goals that peers emphasise.

Limitations to the study were that the sample was small. This research was aimed at determining the achievement goal emphasis of ADHD and non-ADHD learners at one particular school, in a single district in a single province in South Africa. As a result, there is a low external validity, as the study conducted cannot be generalised to other situations. Given the localised nature of this study, I recommend that the results obtained be confirmed through similar studies of this nature and in other provinces in South Africa. In this way, a better understanding of the environmental factors that affect non-ADHD and ADHD learners' motivation in Mathematics can be obtained.

Rather than focusing on the difficulties that learners have in Mathematics, most of the research on academic success and ADHD has focused on reading disorders. Further research is needed into areas of education concerning ADHD and mathematics understanding. The ways in which empirical realities manifest are much more complex than the broad groupings pointed to in the literature in this paper. Hence, I suggest that further research in this regard should be conducted.

In conclusion, learners' achievement goal orientations can be taken into consideration, when teachers plan learning activities and engage learners in tasks, which can ultimately influence learners' attitudes towards learning and consequently their achievement. One avenue available to teachers to ensure this sustained interest and involvement in quality learning is to explore individual learner's achievement goal orientations and to examine those factors which play a role in and are responsible for developing these goal orientations. Consequently, teachers can then cultivate and promote appropriate goal orientations amongst their learners which lead to an improvement in academic achievement.

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