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THE ACHIEVEMENT GOAL ORIENTATION OF DISADVANTAGED PHYSICAL SCIENCES STUDENTS FROM SOUTH AFRICA

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Introduction

The demise of apartheid in South Africa and the birth of a new democracy resulted in the need to transform the education landscape. The previous education system was racially divided into departments for Blacks, Whites, Colored and Indians with discriminatory funding policies. This was evidenced in the capitation for Black and White students, where the per capita expenditure for a White student was five times that for a Black student (Foundation for Research Development, 1993). A legacy of the apartheid policies is therefore the enormous diversity of schools.

One of the key imperatives in the transformation of education was the need to provide quality education for all (Department of Education, 2001). In response to this, the South African government developed policies that sought to enhance the quality of education. The Department of National Education's White Paper 1 on Education and Training (1994) provided a framework for the transformation of the education system. The main thrust for science education in this document is the improvement in the quality of school science for Black students so that strides towards equity could be made.

A strong force driving change in Physical Sciences education was the assertion that the previous curriculum was both inaccessible and irrelevant to Black students. This inaccessibility related not only to the fact that many students were not offered the opportunity to do Physical Sciences as a subject, but also those who did attempt the subject performed poorly. Lewin (1995) points out in 1990, over 75% of all passes in Physical Sciences were obtained by White students, and about 12% by both Indians and Coloureds. Only 1 in 1000 Black students achieved matriculation (final year grade 12 exit examination) with mathematics and science as subjects.

Abstract. *This study attempted to identify the achievement goal orientation of grade 12 Physical Sciences students from disadvantaged communities, and thereafter explain goal orientation by investigating its interaction with teacher, school and parent goal emphasis. The research adopted a mixed methods design involving first a quantitative survey of 300 students from 6 schools using an achievement goal questionnaire developed by Vedder-Weiss and Fortus (2010), followed by interviews with 12 students that served to explicate the trends revealed from the survey. A finding of this study was that disadvantaged Black students have a much stronger performance goal orientation in comparison to a mastery goal orientation. Students perceive the teacher, school and their parent to emphasize such a goal orientation. Despite disadvantaged students being motivated to perform well and achieve high marks in science, the dismal grade 12 results in the national Physical Sciences examination does suggest that a performance goal orientation of students may not be ideal.*

Key words: achievement goal orientation, mastery goal, performance goal, science learning.

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The African National Congress (ANC) policy framework document (1994) described the status of science education in Black schools as follows:

Science and mathematics education in Black schools in South Africa is characterized by a cycle of mediocrity. The infrastructure for the teaching of science and mathematics is poor, especially at senior secondary level. Materials are in short supply. Most schools lack laboratories. Teachers are under qualified. In Black colleges of education, science and mathematics are low status subjects only taught at matriculation level to diploma students. Under qualified and poorly prepared teachers in turn produce weak and poorly prepared school students . . . The cycle of mediocrity is reinforced by the unsuitable nature of the science and mathematics curriculum in the schools. The curriculum is academic, outmoded, and overloaded (p. 45).

In an attempt to address the above concerns and also the imbalances in the education system, a new outcomes-based curriculum was introduced in 1998. This curriculum advocates a student-centred and activity-based approach to education (Department of Education, 2003). This signalled a significant paradigm shift in the manner in which the student was portrayed, as the previous curriculum was characterized by student passivity and teacher-directedness. Large-scale research in South Africa reveals that despite significant reform in science education in this country, there is little to suggest that the quality of learning has improved. For instance, the Trends in International Mathematics and Science Studies (TIMSS) repeated over the years from 1990 to 2003 revealed that the performance of South African students in mathematics and science was very poor compared to other developing countries. According to the Global Competitiveness Report (2010-2011), South Africa ranks 137 out of 139 countries in mathematics and science education quality.

Poor motivation towards science learning amongst others has been identified as a factor affecting performance in science amongst Black students (Mji & Makgato, 2006). This is hardly surprising in view of the deficits in both human and physical resources encountered by Black students in the subject. Research in science education has focused largely on cognition, and there is a need to turn our attention to affective constructs such as student motivation (Schunk, Pintrich & Meece, 2008). Studies have revealed that students' motivation towards science learning declines throughout their years at school (e.g., Galton, 2009; Osborne, Simon & Collins, 2003).

Achievement Goal Orientation

Motivation to achieve in school can be understood in terms of the different goals students bring to a situation (Ames, 1992). These goals provide students with a sense of direction and a reason to engage in an activity (Pintrich, 2000). A key construct in achievement goal theory is the goal orientation, and this refers to why and how students engage in academic activities (Vedder-Weiss & Fortus, 2010). It is very possible that two students are equally motivated yet have vastly different reasons why they are motivated (Ryan & Deci, 2000). Achievement goal theory focuses on understanding these different goals. The theory specifies two main goal orientations. With a mastery goal, the focus of attention is on the intrinsic value of learning (Meece, Herman & McCombs, 2003) with an orientation towards developing new skills, understanding the work, improving one's competence and a sense of mastery based on self-referenced standards (Ames, 1992; Brophy, 1983). Students who adopt mastery goals tend to persist in the face of difficulty, seek challenging tasks, and have high intrinsic motivation (Ames, 1992; Dweck, 1986; Nicholls, 1984). They are also not concerned about how many mistakes they make or how they appear to others, but view mistakes as learning opportunities and do not hesitate to ask others feedback and help (Koballa & Glynn, 2007). The second orientation according to this theory is a performance-approach goal, where the student's main concern is the outward showing of competence (Ames, 1992). Especially important to a performance orientation is public recognition that one has done better than others or performed in a superior manner (Meece, Blumenfeld & Hoyle, 1988). In contrast to a mastery goal orientation, students who adopt performance goals are expected to minimally persist in the face of difficulty, avoid challenging tasks, and have low intrinsic motivation (Ames, 1992).



The benefit of examining goal orientations is that we become better informed on the reasons why students achieve in academic settings (Anderman, Austin, & Johnson, 2001). This information can provide guidelines on how learning environments need to change so that learning can be optimized (Stipek, 2002). Studies have pointed to a relationship between students' adopted goal orientations and the cognitive strategies they employ when learning (Ames & Archer, 1988; Elliot & McGregor, 2001; Pintrich, 2000). For example, students who are motivated to simply score high marks on tests may resort to rote learning to get an "A" on the test, but develop limited higher order thinking. Thus, a teacher who is aware of this goal orientation can emphasize methods that stimulate motivation to learn for reasons beyond grades (Ames, 1992; Ames & Archer, 1988; Stipek, 2002).

Influences on Achievement Goal Orientation

Achievement goal theory highlights environmental characteristics that may foster different orientations (Kaplan & Maehr, 2007; Mucherah, 2008). These include teacher-related classroom factors, school culture and parental influence.

Epstein (1989) identified six classroom factors that affect motivation: task design, distribution of authority, recognition of students, grouping arrangements, evaluation practices, and time allocation. The acronym TARGET has been used to represent these six factors. I will briefly discuss these factors and their possible influence on students' goal orientation. Students' perception of tasks and activities influence how they approach learning. For example, students are more likely to engage in learning in a manner consistent with mastery goal when they perceive meaningful reasons for engaging in a task (Niewandt, 2006). Authority involves the degree of opportunity that students have to take leadership roles and develop a sense of independence and control over learning activities. It is fostered by allowing students to participate in decision making, giving them leadership roles, and teaching them skills that allow them to take responsibility for learning. Recognition relates to the formal and informal use of rewards, incentives, and praise, which have important consequences for motivation to learn. Grouping focuses on the students' ability to work effectively with others. Evaluation involves methods used to monitor and assess learning. Time encompasses the appropriateness of workload, the pace of instruction, and the time allocated for completing work.

School-wide characteristics can be referred to as "school culture" (Vedder-Weiss & Fortus, 2010) and it has been suggested that they may play a central role in fostering or de-emphasizing students' mastery goals, beyond the influence of a teacher (Kaplan & Maehr, 1997). Barth (2002) defines school culture as a complex pattern of norms, attitudes, beliefs, behaviour, values, ceremonies, traditions and myths which is deeply embedded in each aspect of the school. Hinde (2004) refers to it as a set of expectations and assumptions which directly influences the activities of the staff and students. According to Renchler (1992) the influence of school culture as a conduit for motivating students in their learning has been underestimated. Teachers have traditionally shouldered most of the burden of motivating students in their learning, however research continues to demonstrate the powerful effect of school culture on students' attitudes toward education. Narvaez (2010) argues that school cultures are powerful because they meet students' needs for belonging, competence, and autonomy and that "high support and high expectations for both achievement and behavior produces the best results" (p. 659).

Studies have indicated that parents influence their children's motivation for learning in science (e.g., Breakwell & Beardsell, 1992). There is evidence to suggest that students who receive much support and encouragement from their parents tend to adopt mastery goals and demonstrate more persistence and effort when faced with difficult and challenging learning tasks (Hokoda & Fincham, 1995).

Against this background, the following research questions are formulated:

1. What is the achievement goal orientation of disadvantaged Black Physical Sciences students?
2. Is there an interaction between student perceptions of teachers', schools' and parents' goals emphasis for science learning and their achievement goal orientation?



Methodology of Research

General Background of Research

The purpose of this study was to investigate, using the lens of achievement goal orientation, the motivation of Physical Sciences students from disadvantaged communities in their final year of schooling. This study adopted a 'sequential explanatory mixed methods' design (Creswell, 2003). This design enabled me to "collect both quantitative and qualitative data, merge the data, and use the results to best understand a research problem" (Creswell, 2002, p. 564).

Instrument

Quantitative data was collected by means of an achievement goal questionnaire developed by Vedder-Weiss and Fortus (2010). The questionnaire is comprised of items which have been developed to test student perception of the two goal orientations in science achievement already described and constructs relating to teacher, parent and school goal emphasis. The items were statements to which students had to respond on a 5-point Likert scale that ranged from 1 (not true at all) to 5 (very true) (see Appendix A). For example, in relation to the students' personal mastery goals orientation, an item statement that targeted this construct was "It's important to me that thoroughly understand my classwork". Correspondingly, the item "One of my goals is to look smart in comparison to the other students in my class" is directed at the construct on students' personal performance goals orientation. The original questionnaire was piloted in 2011 with South African grade 10 students from township schools. Interviews with these students on the readability of items resulted in minor modifications. For example in each of the items the term "grades" that appeared in the original questionnaire was confusing to students and was substituted with "marks".

The internal reliabilities of constructs to which items were related were evaluated by calculating Cronbach's alpha for each scale. Items that interfered with the reliability were deleted. Table 1 presents the constructs assessed by the questionnaires, the number of items clustered in each construct, and Cronbach's alpha for each construct.

Table 1. The constructs assessed by the questionnaire.

Number of items	Cronbach's Alpha	Construct
7	0.76	Student personal mastery goal orientation
5	0.72	Student personal performance goal orientation
9	0.69	Student perception of teacher mastery goal orientation
4	0.73	Student perception of teacher performance goal emphasis
6	0.75	Student perception of school mastery goal emphasis
5	0.66	Student perception of school performance goal emphasis
5	0.70	Student perception of parent's mastery goal emphasis
4	0.69	Student perception of parent's performance goal emphasis

Sample

The questionnaire was administered to 300 grade 12 Physical Sciences students from 6 township schools. These schools were chosen using purposeful sampling which entails "selecting information-rich cases for study in-depth" (Patton, 1990, p. 169). As the study focused on disadvantaged students, the sample was constituted of students in township schools. In South Africa, the term township usually refers to underdeveloped urban living areas that from the late 19th century until the end of Apartheid

were reserved for non-Whites (Black Africans, Coloureds and Indians). Townships were usually built on the periphery of towns and cities.

Data Analysis

The questionnaire data were analyzed by computing scores on the above achievement goal constructs (scales). Correlation analysis was used to describe the strength and direction of the relation between the constructs. Interviews were then conducted with 12 students exhibiting an extreme goal orientation. Two students were identified per school. The interviews served to probe students on possible factors influencing their goal orientation. For example, a student showing a performance goal orientation was asked to explain why he or she felt the need to appear smart compared to other students in class. All interviews were recorded and later transcribed. The interviews were analysed using computer-aided qualitative data software, Atlas.ti. Data were coded and classified, a process that involved breaking up data into bits and bringing it together again in a new way (Smit, 2002). This process was largely guided by the environmental characteristics of achievement goal orientation such classroom factors, school culture and parental influences that have already been described. I firstly did an open coding of data, and then grouped the codes into code families. These code families corresponded with the environmental characteristics of achievement goal orientation.

Results of Research

The findings from the analysis of the questionnaire survey were integrated with the findings from the student interviews into a coherent whole. The interview data explained some of the findings which emerged from the questionnaire analysis. This integration of quantitative and qualitative data supported the production of assertions (Gallagher & Tobin, 1991) on the achievement goal orientation of students. These assertions are presented next.

Assertion 1: Disadvantaged Black Physical Sciences students perceive that they have a stronger performance goal orientation than a mastery goal orientation.

An analysis of questionnaire data indicated that students from disadvantaged communities have a stronger performance goal orientation ($M = 4.23$, $SD = 0.81$) than mastery goal orientation ($M = 2.35$; $SD = 1.06$).

The above result suggests that students are strongly motivated by achieving good marks in assessment tasks and getting recognition for performing better than their peers. For example, in responding to the item "In our science class, it's important not to do worse than other students", the means score was 4.4. All 12 students interviewed exhibited a strong performance goal orientation. In the interviews the students were questioned on what motivated them in science learning. The following interview responses underscore the performance goal orientation of students:

I want to do very well in science to get high marks. I try hard to get this and do all my work every time. When I study for a test I go over all the work from start to finish. I memorize all the definitions so that I must not lose any marks.

I must get good marks to show my classmates who is good. I want to prove it with the highest marks in science.

In contrast, the much lower mean score for the mastery goal orientation shows that student achievement goal is weakly driven by the intrinsic value of learning science, namely the development of conceptual understanding in science, and science process skills. This is further evidenced by student responses to the item "An important reason why I do my science class work is because I like to learn new things" where the mean score was 2.8. Eight of the twelve interviewed student responded "not true" to this statement in the questionnaire. When asked to elaborate upon this response, they indicated that



they willingly complied in doing their classwork whenever the teacher informed them that it was for assessment purposes, while on other occasions they did not attach the same importance to the task. They were quite candid in advancing that the objective of learning science by doing the classwork set by the teacher was secondary to their primary goal of getting a high mark for the task. The following responses attest to this observation:

Sometimes I do enjoy the classwork set by my teacher, but I always hope to get some good mark for this. The mark shows me if I am doing good and learning a lot.

We can always do the work, but we must show something for it. I can do well in learning by having the mark for it.

The influences accounting for these findings on the achievement goal orientation of students were then investigated, and the next assertion relates to this.

Assertion 2: The performance goal orientation of students is related to the goals emphasis of teachers, the school and parent as perceived by students.

A correlation analysis was performed to examine how student goal orientation was related to teacher goal emphasis, school goal emphasis and parent goal emphasis (Table 2).

Table 2. Correlations between student achievement goal orientation, parent's goal emphasis, teacher goal emphasis and school goal emphasis.

	1	2	3	4	5	6	7	8
1. Student mastery goal orientation	—	-0.52*	0.61**	0.12	0.55*	0.24	0.38*	0.03
2. Student performance goal orientation	—	—	0.16	0.66*	-0.61*	0.63*	0.17	0.64*
3. Teacher mastery goal emphasis	—	—	—	-0.38	0.45*	-0.40	0.27*	0.22
4. Teacher performance goal emphasis	—	—	—	—	-0.48*	0.61**	0.19	0.39
5. School mastery goal emphasis	—	—	—	—	—	-0.56*	0.58*	0.52**
6. School performance goal emphasis	—	—	—	—	—	—	0.11	0.61*
7. Parent mastery goal emphasis	—	—	—	—	—	—	—	-0.67*
8. Parent performance goal emphasis	—	—	—	—	—	—	—	—

** correlation is significant at the 0.01 level (2-tailed)

*correlation is significant at the 0.05 level (2-tailed)

It is evident from this analysis that there is a strong, positive correlation between student performance goal orientation and teacher performance goal emphasis ($r = 0.66, p < 0.05$). This relationship was explored further in the interviews. The students alluded to the emphasis placed by the teacher on getting high marks on assessment tasks and instilling competitiveness amongst students. This is evident in the following excerpts from the interviews:

I need to do well because my teacher compares our marks to each other. Those getting the good marks are praised.

I feel so good when I get a higher mark than the others because the teacher is very happy. He even singles us out and lets us do whatever we want for some time.

I get scared to get a bad mark. My teacher gets upset and shouts us insults. I feel like I must always do better than the others.

It is clear from the above responses that these students are motivated to achieve in science by their desire to appease the teacher who attaches great importance to performance in the subject. There is also a suggestion from the last response of the student's performance avoid goals emphasis where the student adopts a performance goal orientation to avoid being discriminated due to poor performance. The significance of the strong correlation between the performance goal orientation of students and the perceived performance goal emphasis of teachers is reinforced by the large extent to which teachers are perceived to emphasise a performance goal in their classroom (student perception of teacher performance goal emphasis, $M = 4.18$, $SD = 1.21$). This perception by students appears to be shaped by classroom factors such as evaluation practices, the authority of the teacher and grouping arrangements. All twelve students who were interviewed indicated that the assessment tasks given were predominantly summative and comprised of tests and examinations. Assessment feedback on academic performance appeared to be judgemental rather than being continuous and formative. When asked to describe any activities that did not count for marks, they could only recall a regional science expo that some students participated in. Assessment was therefore geared towards a performance goal emphasis.

In exploring a link between the classroom distribution of authority and the goal orientation of students, they were asked to describe a typical science lesson. It was inferred from their responses that lessons are heavily teacher-directed with students being given only limited opportunities to explore their own ideas through stimulating activities. The following interview responses elaborate upon this:

We spend most of the lesson listening to our teacher and then take down notes. I thought science was supposed to be fun like in the primary school. Here we just sit and have to write a test. We must listen carefully so we know how to answer the test questions.

We are always doing a lot of work. This is my second science notebook. Mr Mkhize (*the teacher*) gives a lot of notes from the board. We study it hard to try and pass, but I am struggling. Sometimes we can ask questions, but we have to keep pace at all times.

Everything is assessed. Nothing is for fun. After every section we write tests and must get our parents to sign it.

The classroom seating arrangement supported a teacher controlled environment. Based on the description given by the interviewed students it was clear that they would normally be seated in rows facing the teacher. When questioned on why they believed the teachers seated them in this fashion, they referred to this being the most effective way for them to all listen to the teacher and follow his explanations so that they could do well in tests and examinations. This is clearly evident in the following interview excerpt:

We face the board most of the time because the teacher is there. He wants us to be always looking front to concentrate on the lesson. We must listen to him so we don't miss out on anything to come out in the test.

This is best for us all to be looking at him all the time. We cannot turn around to discuss anything unless he tells us.

It is therefore evident the classroom factors support a performance goal orientation where students are motivated by the imperatives of getting a good mark in science.

An analysis of the student perception of the schools' achievement goal emphasis revealed that



they strongly believe that the school attaches more importance to a performance goal ($M = 3.98$, $SD = 0.87$) than a mastery goal ($M = 2.6$, $SD = 1.13$).

The strong positive correlation between student performance goal orientation and the schools' performance goal emphasis as perceived by students ($r = 0.63$, $p < 0.05$) reflects an association between these two construct. When students who displayed a strong performance goal orientation were asked to explain their orientation, they made reference to how the few students who performed well in tests and examinations received high praise and were given special recognition. This was evidenced in the following responses:

At this school the top students are treated like heroes. It is all about getting the highest mark. The awards ceremony is a big thing and the principal sometimes goes over the top and saying we must all do the same.

We are made to look stupid in front of the achievers. I am good at sport but they don't worry about that now. It is now all about passing your school work.

They also spoke of the school principal who closely monitors their progress throughout the year. When asked to explain why they thought the school principal placed such a strong emphasis on them doing well, the students alluded to how the management of the school was under pressure from the provincial department of education for them to do well in science. In the responses below, the students refer to their school as being one that has been identified by the department of education for support due to poor performance in the previous year's national grade 12 examination.

Mr Jabu (*the principal*) must make sure we can pass. I see officials from the department coming all the time. They are always coming and checking our books. Mr Jabu will lose his job if we fail at the end of this year.

It was also evident that when students underperformed, much pressure was brought to bear upon them by the management of the school. In such cases students were "summoned" to the principal's office and sometimes parents were invited to discuss their child's progress. This is clear from the following response:

If you are not making it in grade 11 you can be made to leave. Sometimes they even ask you to register as a private student. You can also expect your parent to be called.

Furthermore, the strong negative correlation between student performance goal orientation and student perception of the schools' mastery goal orientation ($r = -0.61$, $p < 0.05$) shows that the high levels of student performance goal orientation was associated with lower levels of the schools' mastery goals orientation. This negative correlation is largely explained by the schools' emphasis on test and examination performance at the expense of the intrinsic value of science learning characterised by the development of understanding, skills and the enjoyment of science.

The correlation analysis shows a strong positive correlation between student performance goal orientation and students' perception of parent performance emphasis ($r = 0.61$, $p < 0.05$). This indicates a strong relationship between these two constructs, with high levels of student performance goal orientation associated with high levels of parent performance emphasis. Students also perceive that their parents have placed a much heavier emphasis on performance ($M = 3.92$, $SD = 1.13$) than on mastery goals ($M = 2.1$, $SD = 0.93$). The interviewed students referred to how parents believed that by them getting high marks in science, it would lead to self-advancement by improving the prospects of them getting a good job. This is apparent from the following excerpts:

My parent sees good symbols in subjects like science and maths as creating opportunities for me to further myself. They believe your future is secured through high marks and doing well in the exams. They always remind me on this.

I can say that my dad is really hoping for me to do better than the other children. He always says it is a tough world out there and I must show at school that I am better than the others. He thinks a good symbol in science will give me a bright future.

When asked about whether their parents wanted them to enjoy the learning of science, the students indicated that their parents attached less importance to enjoyment of the subject and more on them getting good marks in the subject. This is underscored by the following interview excerpt:

I am sure they want me to like and enjoy doing science, but at the end of the day it must be about scoring high marks. Enjoying science doesn't count for them.

The interviewed students also commented on how when they performed poorly at science their parents reprimanded them for this by denying them recreational privileges such as attending soccer matches and going to the movies.

The correlation analysis between the constructs clearly reflects that the strong student performance goal orientation in science is strongly related to the emphasis placed by the teacher, the school and the parents on performance.

Discussion

A finding of this study was that disadvantaged Black students have a much stronger performance goal orientation in comparison to a mastery goal orientation. In adopting a performance goal orientation, students were motivated in attaining a favourable judgement of their competence in comparison to their peers. In attempting to understand the goal orientation of students, the study also investigated the goal emphasis of the teacher, school and parents as perceived by students. It was revealed that there is a strong emphasis on performance goals by all three role players. This finding is not surprising given the focus on high-stakes summative assessment in the form of tests and examinations in South Africa's education system. According to Harlen and Deakin Crick (2003) the assessment activities used in the classroom convey important information to students about its value, and hence have an influence on their achievement goals (Ames, 1992). The importance students attach to getting good marks, especially in comparison to peers was also underlined in a systematic review of research on the impact of high-stakes tests on aspects of students' motivation for learning (Harlen & Deakin Crick, 2003). The review showed that an education system that puts great emphasis on summative assessment produces students with strong extrinsic orientation towards grades and social status. This has a detrimental effect of on students' enjoyment of school, their willingness to learn, other than for the purpose of passing tests or examinations, and their understanding of the process of learning (Pollard et al., 2000).

The sample chosen was comprised of students from disadvantaged communities having a low socio-economic status. In South Africa, there is strong competition amongst students to secure a place at university as it is claimed that a university qualification will improve the socio-economic status of the person. There is some validity to this claim as a 2009 study by the South African Labour and Development Research Unit found that South Africans who have graduated from university are three times more likely to get a job and on average will earn up to four times more than those who did not finish schooling. The finding on students adopting a performance goal orientation suggests that they are driven to achieve high marks in the subject to enable them to access university education.

Research on learning in relation to the goal orientation of students points out that mastery goals in science learning has a positive relation with desired learning characteristics and therefore should be encouraged and fostered by parents, teachers, and schools. For example, in the field of science education, Patrick and Yoon (2004) found that increased conceptual understanding is related to mastery goals. Furthermore, a study by Belenky and Nokes-Malach (2012) suggests that mastery goals may serve as a "mechanism of transfer that facilitates constructive cognitive processes and helps connect later learning episodes with relevant earlier learning" (p. 426). Furthermore, the finding on disadvantaged South African students having a strong performance goal orientation differs from that reported



in other countries where evidence suggests that students hold multiple goals in classroom situations (Harackiewicz, Barron, & Elliot, 1998; Pintrich, 2000; Meece & Holt, 1993). According to Meece, Herman and McCombs (2003), research has further suggested that multiple combinations of goals (e.g., high mastery and high performance) may have different achievement outcomes (Kaplan, Middleton, Urdan, & Midgley, 2002).

Conclusion

The present study attempted to identify the achievement goal orientation of grade 12 Physical Sciences students, and thereafter explain goal orientation by investigating its interaction with teacher, school and parent goal emphasis. In view of the historical inequities in the quality of science education in this country, this study investigated the motivation of students from disadvantaged schools through the lens of achievement goal theory. There is a growing body of research that underlines the importance of motivation in science learning. This study attempted to inform on the motivation of a particular group of students who have historically performed poorly in science and whose performance in the subject has been strategically prioritised nationally.

The finding of this study regarding the dominant performance goal orientation of students and their weak mastery goal orientation does raise concern. Despite disadvantaged students being motivated to perform well and achieve high marks in science, the dismal grade 12 results in the national Physical Sciences examination does suggest that a performance goal orientation of students may not be ideal. Although the poor achievement of students in Physical Sciences may not be solely attributed to the goal orientation of students, in view of the desirable learning characteristics associated with a mastery goal orientation, it is recommended that this goal orientation be more actively encouraged.

The results of this study show that students perceive their teachers to have a strong performance goal emphasis. The implication of this finding is that there is a greater need for research to identify those aspects of science teaching that make school science engaging for students. There is therefore a need for qualitative investigations of the relationships among motivation constructs and achievement in academic contexts that would contribute insights not readily obtainable through quantitative research. A study that includes interviews both with students and teachers as well as classroom observations could enlighten on the social and interpersonal context of the classroom and the school, and thereby inform on an appropriate pedagogy in science that would promote a desirable goal orientation for students.

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Appendix A

Achievement goal constructs and item statements in student achievement goal questionnaire

Students' Personal mastery goals orientation

- It's important to me that I improve my skills this year.
- An important reason why I do my work in class is because it is important to me to improve my knowledge.
- It's important to me that I thoroughly understand my class work.
- An important reason why I do my work in class is because I want to get better at it.
- I do my work in class because I want to learn and advance as much as possible.
- An important reason why I do my class work is because I like to learn new things.
- I like class work that I'll learn from even if I make a lot of mistakes.

Students' Personal performance approach goals orientation

- One of my goals is to show others that class work is easy for me.
- One of my goals is to look smart in comparison to the other students in my class.
- It's important to me that I look smart compared to others in my class.
- One of my goals is to show others that I'm good at my class work.
- It's important to me that the teacher and other students will think that I'm good at studies.

Students' perception of Teacher's mastery goals emphasis

- My teacher thinks mistakes are okay as long as we are learning.
- My teacher wants us to understand our work, not just memorize it.
- My teacher recognizes us for trying hard.
- My teacher encourages and appreciates students that try hard and improve.
- My teacher gives us time to really explore and understand new ideas.
- My teacher helps us see how what we learn relates to the real world.
- My teacher uses lots of other interesting materials to teach, not just our textbook.
- My teacher encourages students to find different ways to solve problems in class
- My teacher encourages us to find interesting and different ways to do our assignments.

Students' perception of Teacher's performance approach goals emphasis

- My teacher tells us how we compare to other students.
- My teacher points out those students who get good grades as an example to all of us.
- My teacher lets us know who gets the highest scores on a test.
- My teacher calls on smart students more than on other students.

Students' perception of School's mastery goals emphasis

- In my school students are told that making mistakes is OK as long as they are learning and improving.

In my school students are frequently told that learning should be fun.
In my school the emphasis is on really understanding schoolwork, not just memorizing it.
In my school a real effort is made to recognize students for effort and improvement.
In my school a real effort is made to show students how the work they do in school is related to their lives outside of school.

Students' perception of School's performance goals emphasis

In my school it's easy to tell which students get the highest grades and which students get the lowest grades.
In my school students who get good grades are pointed out as an example to others.
In my school students hear a lot about the importance of getting high test scores.
In my school grades and test scores are not talked about a lot.
My school emphasizes getting high grades.

Students' perception of parents' mastery emphasis

My parents would like me to do challenging class work, even if I make mistakes.
My parents want me to see how my class work relates to things outside of school.
My parents want me to understand concepts, not just do the work.
My parents want me to understand my class work, not just memorize how to do it.
It's important to my parents that I learn new and interesting things.

Students' perception of parents' performance emphasis

My parents think getting the right answers in class is very important
My parents would like it if I could show that I'm better at class work than other students in my class.
My parents would be pleased if I could show that class work is easy for me.
My parents would like me to show others that I am good at class work.

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